ELECTRICAL REVIEW

BROOK

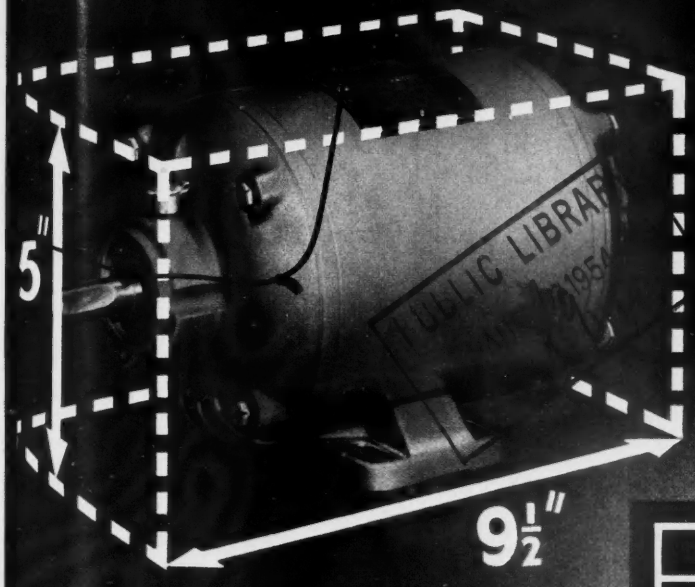
Introduce...

A SMALLER "FRACTIONAL"

... The

B.S. 42

Write for detailed list.



OUTPUTS

THREE PHASE SUPPLY					
PROTECTED			TOTALLY ENCLOSED		
H.P. at Syn. Speeds			H.P. at Syn. Speeds		
3000	1500	1000	3000	1500	1000
½	¼	⅛	½	¼	⅛
SINGLE PHASE SUPPLY					
H.P. at Syn. Speeds			H.P. at Syn. Speeds		
3000	1500	1000	3000	1500	1000
¼	⅛	1/16	⅛	1/16	1/25

BROOK MOTORS LTD

1904 1954

HUDDERSFIELD • ENGLAND

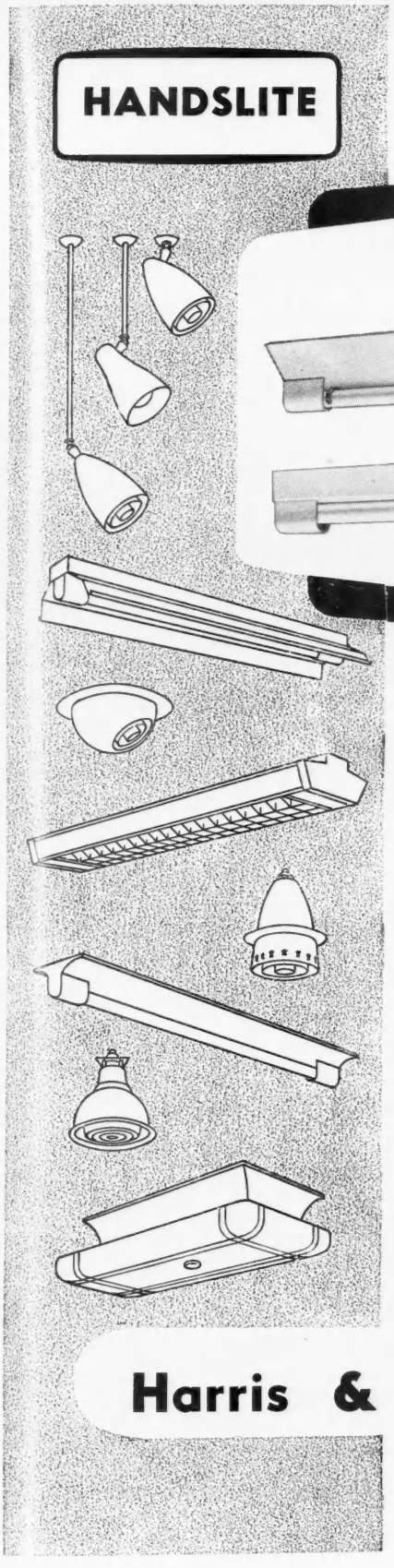
Approved

Stanton 8K Spun Concrete Lighting Columns (shown in our picture) form part of the Stanton range approved by the Council of Industrial Design or passed by the Royal Fine Art Commissions.

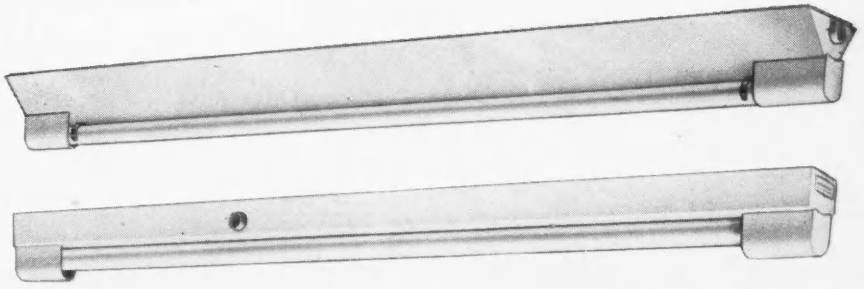
THE STANTON IRONWORKS COMPANY LIMITED — NEAR NOTTINGHAM

HANDSLITE

Fittings of Quality



THE VEE BATTEN



THE BATTEN FITTING

Illustrated above are two fittings which find a wide field of application for all types of lighting requirements. They are manufactured for all sizes of fluorescent lamp, single type only, and are supplied complete with Handslite control gear and starter switch wired ready for use.

Erection and maintenance facilities are excellent and fittings are suitable for either suspension or mounting direct on ceiling.

Made throughout in 20 s.w.g. sheet steel, rustproofed and finished best quality white stoved enamel.

Prices are very competitive. As an example, the 5ft. 80 watt size in either of the designs shown above is priced at only £4 15. 6. LIST complete (excluding lamps).

Prices for other sizes on application.

★ ★ ★ ★ ★ ★

These are only two items from the wide range of lighting equipment which we manufacture.

May we send a copy of our latest catalogue?

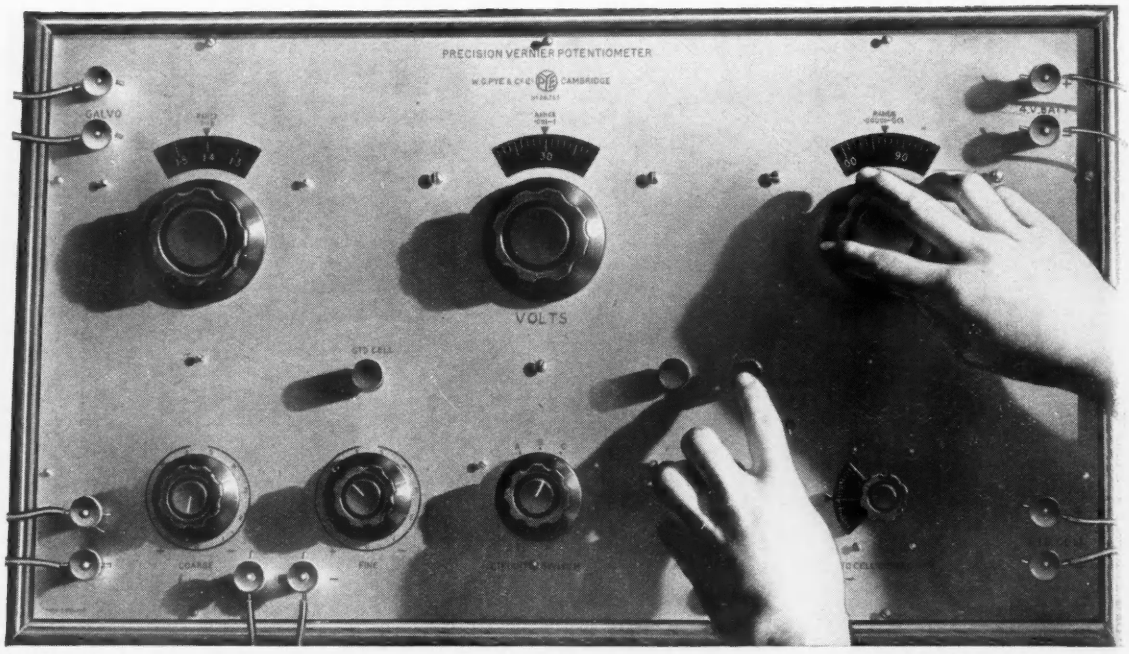
Harris & Sheldon (Electrical) Ltd.

Complete Lighting Specialists and Manufacturers of Light Fittings and Control Gear.

Head Office and Showroom:

31 Stafford Street, Birmingham 4

London Phone: Primrose 0747. Birmingham Phone: Central 7101



Built by Craftsmen .....

Pye Precision Vernier Potentiometer

ACCURACY WITHIN YOUR GRASP

Designed for measurements of a very high order of accuracy, this VERNIER potentiometer is being used extensively for the accurate measurement of resistance, as a standard for calibrating potentiometers, meters and other electrical measuring instruments, for measuring thermo-couple voltages and for many applications of a similar nature. Through every stage of its manufacture the most careful precautions are taken to eliminate possible sources of error.

Please write for details of our range of precision potentiometers which also includes a SLIDE-WIRE type reading to 1 microvolt with an accuracy of .02% as well as a PORTABLE type which is completely self-contained, compact, robust and always ready for immediate use.

Our new catalogue giving details of our comprehensive range of Galvanometers, Shunts, Standard Cells and other precision measuring instruments is available on request. May we please send you a copy?

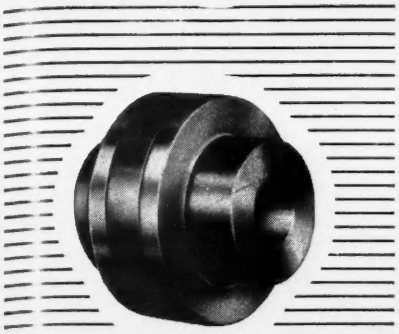
STANDARD EQUIPMENT IN MANY LEADING LABORATORIES

SCIENTIFIC PYE INSTRUMENTS

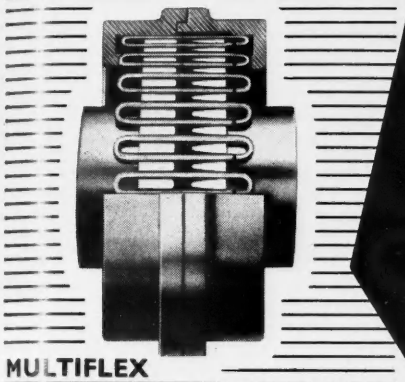
W. G. PYE & CO. LTD., GRANTA WORKS, CAMBRIDGE, ENGLAND

WG 56

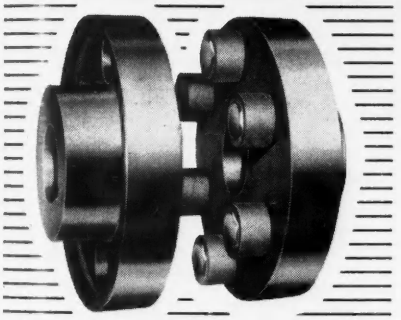
★ AN INDISPENSABLE FEATURE OF MODERN POWER TRANSMISSION••



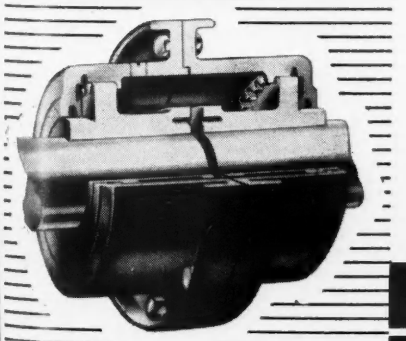
PERFECT



MULTIFLEX



CROWN PIN



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Crofts

FLEXIBLE COUPLINGS

★ Selection of the correct type of Flexible Coupling to protect Driving and Driven Machinery from shocks, sudden overloads, misalignment, etc., is of the greatest importance to ensure Highest Efficiency in Power Transmission.

★ Our catalogue CF.249/9 lists all types of Couplings and gives essential information regarding applications.

Crofts CROFTS (ENGINEERS) LTD., BRADFORD

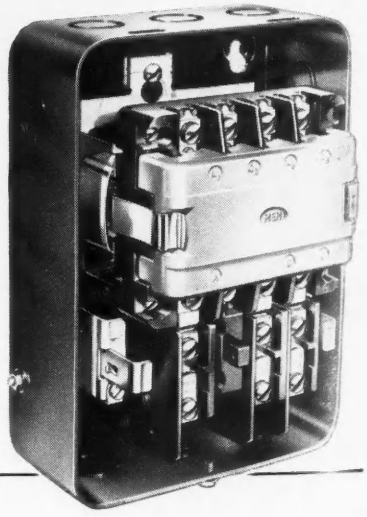
PHONE:— 65251 (10 LINES) GRAMS:— "CROFTERS BRADFORD"

THE FINEST PROTECTION A MOTOR CAN HAVE...

THE NEW MEM 'Autoline' STARTERS 1½ to 15 h.p.

Do you want the finest possible starter for valuable machine tools and other vital applications? Then here is your answer from MEM, the people with more than 30 years experience in large scale production of motor control gear. The "Autoline" is new from start to finish, and is designed for high reliability and long life

Send for "Autoline" Brochure List No. 347



- *Unit construction to meet a wide range of needs from standard units.*
- *Precision overload relays.*
- *One starter for either auto or manual resetting.*
- *Especially easy installation and maintenance.*
- *Complies with performance requirements of BS 587 and the Canadian Standards Association.*

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MIDLAND ELECTRIC MANUFACTURING CO. LTD., TYSELEY, BIRMINGHAM 11. *Branches in London and Manchester*

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B T-H

BRITISH

STANDARD DIMENSION MOTORS

AVAILABLE FROM STOCK

British Thomson-Houston were among the first to manufacture mechanically-interchangeable motors conforming to B.S.2083. Other makers build to this spec., but the BTH range of totally-enclosed fan-cooled squirrel-cage motors up to 20 h.p. have mechanical and electrical characteristics that are unsurpassed.

THE **BRITISH THOMSON-HOUSTON** CO. LTD. · RUGBY · ENGLAND

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MADE IN ENGLAND

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NEW
WARM WHITE

DELUXE
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NATURAL
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DAYLIGHT

CRYSELCO
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Lamps

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BRISTOL	GLASGOW	LIVERPOOL	NEWCASTLE	
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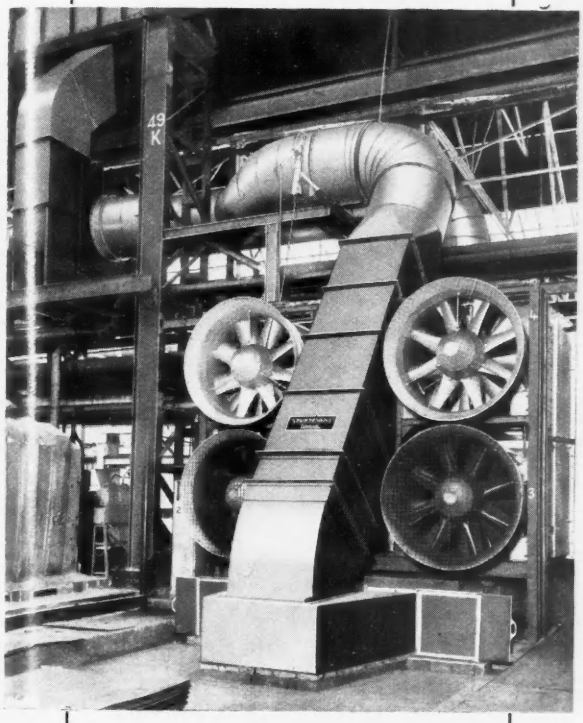
CRYSELCO LIMITED KEMPSTON WORKS BEDFORD

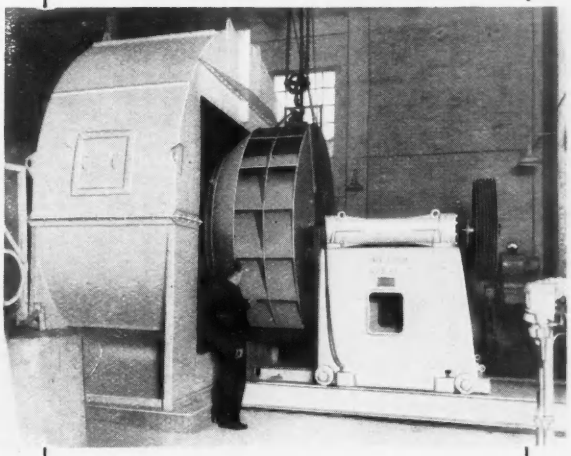
Sturtevant Fans

AXIAL FANS



High efficiency type for high powered units running for long periods. For equal conditions, usually smaller than the equivalent centrifugal fan. Can be installed horizontally, vertically, angularly, within a run of ducting—in single and multistage types.

STEEL PLATE FANS



Manufactured in many types as

MULTIVANE—extensively used for heating and ventilation, drying, fume exhaust, boiler draught, etc., and for relatively large volumes of air for a given capital expenditure.

RADIAL, PADDLE TYPE—unsurpassed for handling air containing abrasive or bulky dust, or for dealing with gases at abnormally high temperatures.

BACKWARD CURVED BLADE TYPE—with self-limiting power characteristic and of higher efficiency than the other types—chiefly applied to large ventilating work.

The illustration top right shows one of several large Sturtevant Backward Curved Blade fans with facilities for withdrawing the impellers. The illustration on the left is of a battery of four 51″ diameter, two-stage, Sturtevant adjustable pitch Axial Fans, blowing air through a heat exchanger for space heating in a steel works. **Sturtevant Fans large or small are made for almost every conceivable duty—and every problem is individually considered. We shall be happy to send details if application is made to reference U.101/100.**

STURTEVANT ENGINEERING CO. LTD.

Southern House Cannon Street London EC4

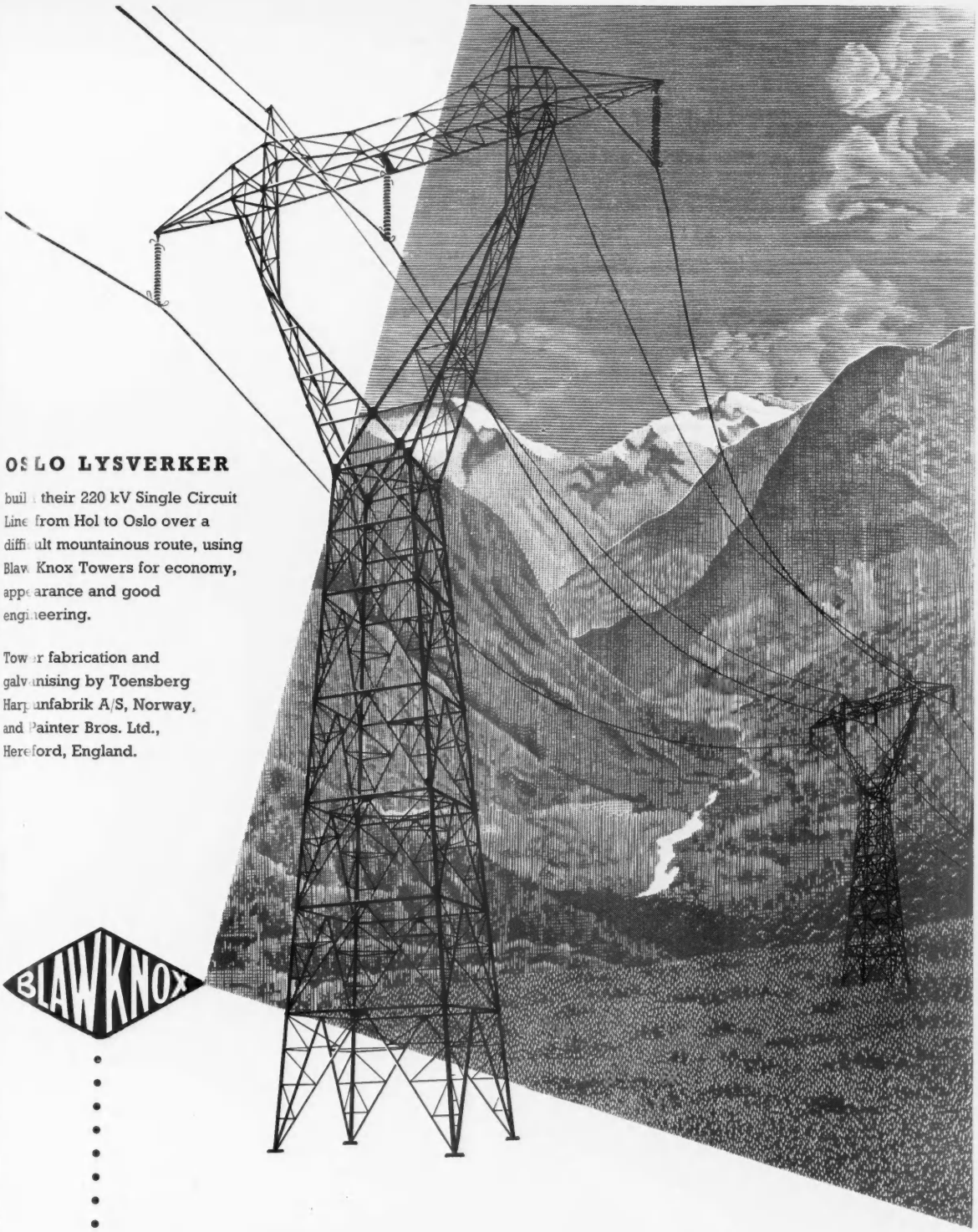
What shall we play on it?

Our repertoire on the Austinlite Rotary is almost inexhaustible. Choose a switching composition as complex as you please and it is a practical certainty that an Austinlite Rotary will not only handle it, but handle it with less fuss and complication and in less space than any other method you can think of.

We can do anything you ask with Austinlite rotaries because every switch is built for its job, no matter how special the job may be.

Rotary switching is 'SIMPLIFIED SWITCHING' ask AUSTINLITE about it

AUSTINLITE LIMITED, LIGHTHOUSE WORKS, SMETHWICK 40, BIRMINGHAM



OSLO LYSVERKER

build their 220 kV Single Circuit Line from Hol to Oslo over a difficult mountainous route, using Blaw Knox Towers for economy, appearance and good engineering.

Tower fabrication and galvanising by Toensberg Harpunfabrik A/S, Norway, and Painter Bros. Ltd., Hereford, England.

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TRANSMISSION TOWERS

BLAW KNOX LTD · 90-94 BROMPTON ROAD · LONDON SW3

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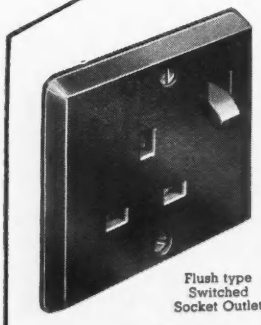
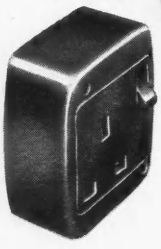
BK 105

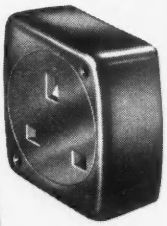
TO-DAY's FINEST RANGE of 13 AMP Shuttered Electrical Accessories



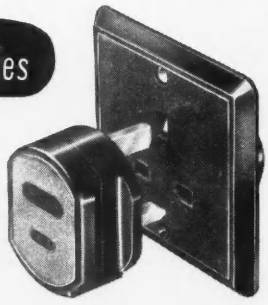
Flush type Switched Socket Outlet



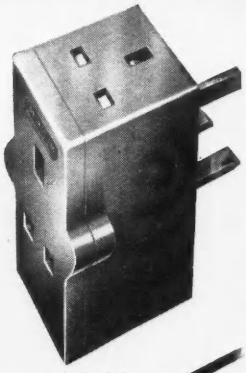
Surface type Switched Socket Outlet



Surface type Socket Outlet



Fused Plug and Flush Socket Outlet



3-outlet Socket Adapter

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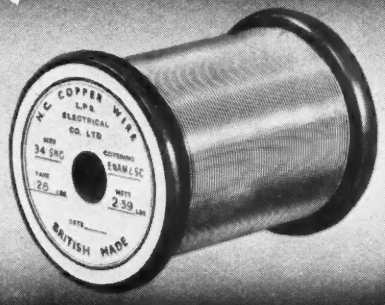
Dependability

INSTRUMENT WIRES
STRANDS & BRAIDS



TELEPHONE & RADIO CORDS
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ELECTRICAL CO. LTD

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TELEPHONE : PERIVALE 5621-4 TELEGRAMS : ENGINEYOR PHONE LONDON

FERRANTI

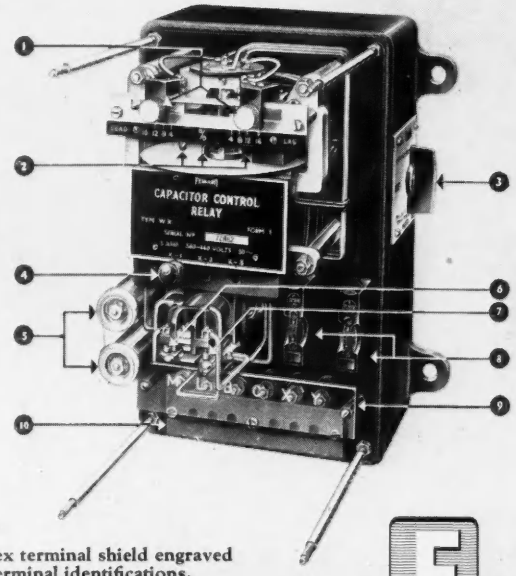
CAPACITOR CONTROL RELAY

(TYPE WR)

FOR SINGLE STAGE CONTROL

This relay provides *automatic power factor correction* when used with suitable capacitors.

- Independently adjustable "lead" and "lag" settings over a wide range.
- Self-contained auxiliary element with substantial contacts to operate the heavy duty capacitor contactor.
- Selector switch to give automatic or manual control as required.



1. Independently adjustable settings for "lead" and "lag".
2. Contacts operated by movement of disc.
3. Switch for auto/manual control.
4. Settings multiplier change plug.
5. Limiting resistors in series with auxiliary relay coil.
6. Auxiliary Relay—main contacts for capacitor control.
7. Auxiliary Relay—"Hold-on" contacts.
8. Fuses.
9. Perspex terminal shield engraved with terminal identifications.
10. Dust-tight entries for wiring to terminals.

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London Office: KERN HOUSE, 36 KINGSWAY, W.C.2.

ELECTRIC CLOCKS · *ALWAYS RIGHT ON TIME*

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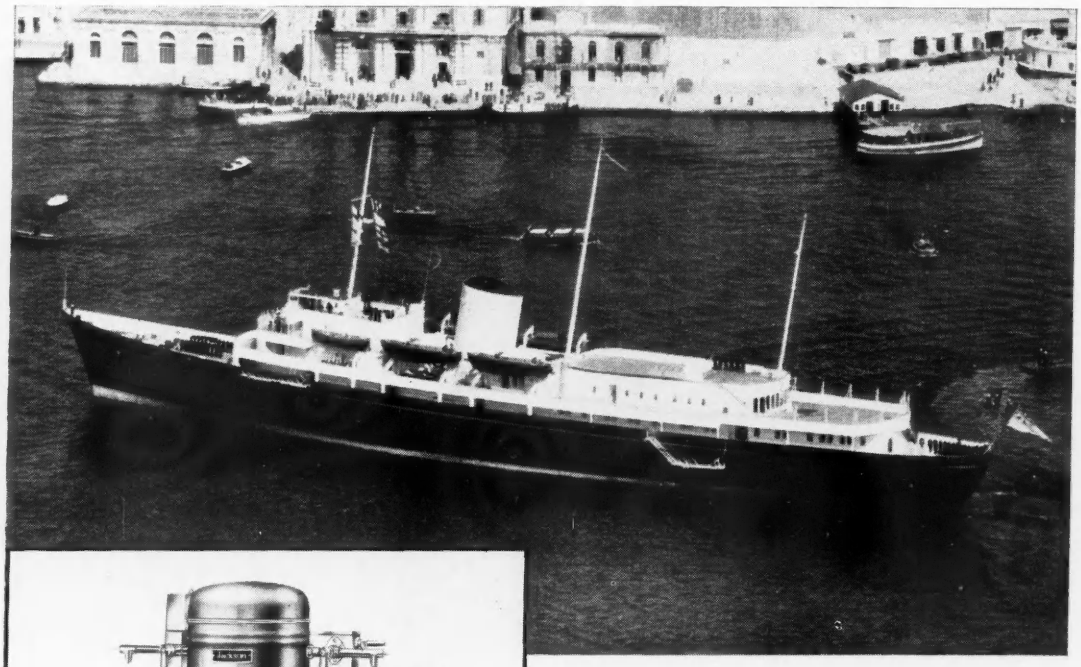


When only the best is good enough

The 'Jackson' Boiler fitted in the Royal Galley is a standard FAEM electrically heated marine type Boiler with 12 pint milk and coffee urns incorporating the 'Jackson' Filtomaton system of coffee making.

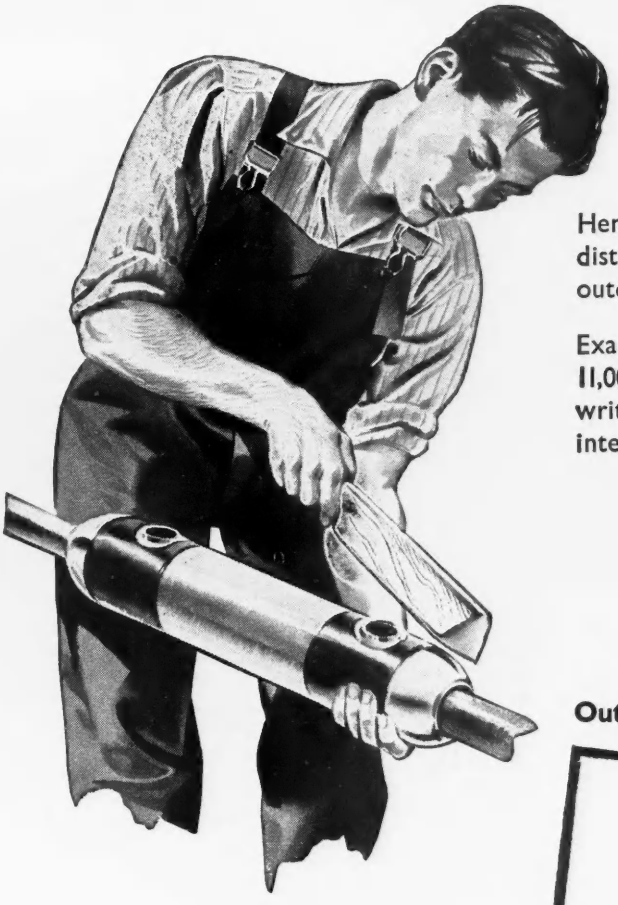
In H.M. Yacht Britannia we continue a proud tradition of service in famous ships - there is a 'Jackson' Boiler for tea and coffee making installed in the Royal Galley. Wherever qualities of reliability and efficiency are essential a 'Jackson' is a confident choice.

There's a 'Jackson' made for every catering need. 'Jackson' Boilers are supreme for all hotel and restaurant catering, cafes, milk bars, works canteens, hospitals and schools.

Jackson Boilers

Jackson Boilers Ltd. Vulcan Works, Shafton Lane, Leeds 11. Tel: 3-1088

Showrooms: 25 Victoria Street (entrance in Abbey Orchard St.), Westminster, S.W.1; 219 West George Street, Glasgow; 28 Deansgate Arcade, Manchester; 9 King Street, Leeds; 202 Corporation Street, Birmingham; 142 Victoria Street, Bristol.



Henley's provide a dependable range of distribution equipment for indoor and outdoor installations.

Examples of equipment for 3,300 to 11,000 volts are illustrated below. Please write for catalogues in which you are interested.

Catalogue 31
Straight Through Joints

Catalogue 32
Indoor Terminal Boxes

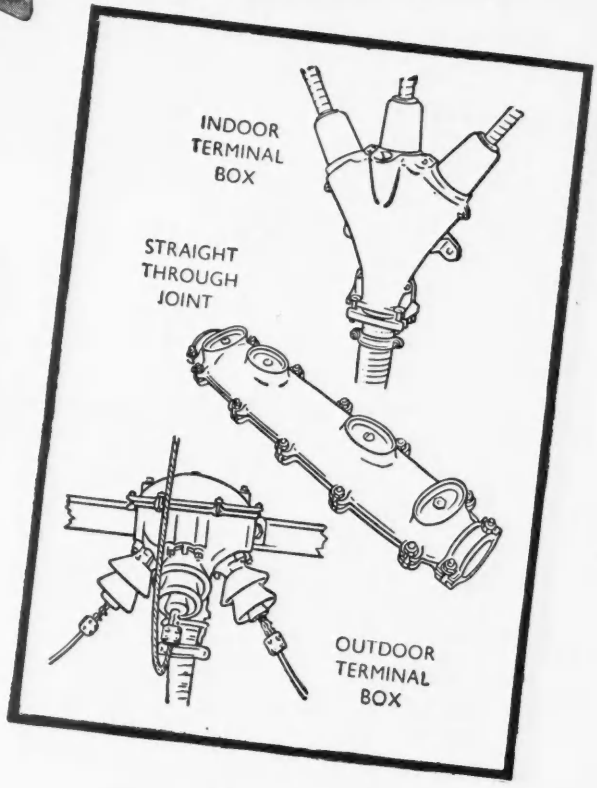
Catalogue 33
Outdoor Terminal Boxes (Inverted)

HENLEY

DISTRIBUTION EQUIPMENT

for

3,300-11,000 volts



W. T. HENLEY'S TELEGRAPH WORKS CO. LTD., 51-53 HATTON GARDEN, LONDON, E.C.1

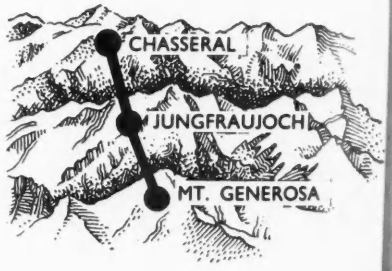
Eurovision

made possible b

The greatest heights yet reached by television . . .

THE GREATEST HEIGHTS yet reached by television are undoubtedly those pioneered by the G.E.C. television link across Switzerland—the vital link in Eurovision. The problems of the long hops over the most difficult Alpine country were solved, and the equipment manufactured and supplied, at short notice by the G.E.C.

This link is to form a permanent installation for the Swiss P.T.T. Department's national television network. It uses G.E.C. microwave radio relay equipment, operating in the 1700–2300 Mc/s range and conveying a 625-line picture transmission. This equipment, too, is to be manufactured by Hasler S.A. . . . on behalf of the G.E.C. . . . to extend the Swiss national network between Uetliberg, Chasseral, Romont and Dole.

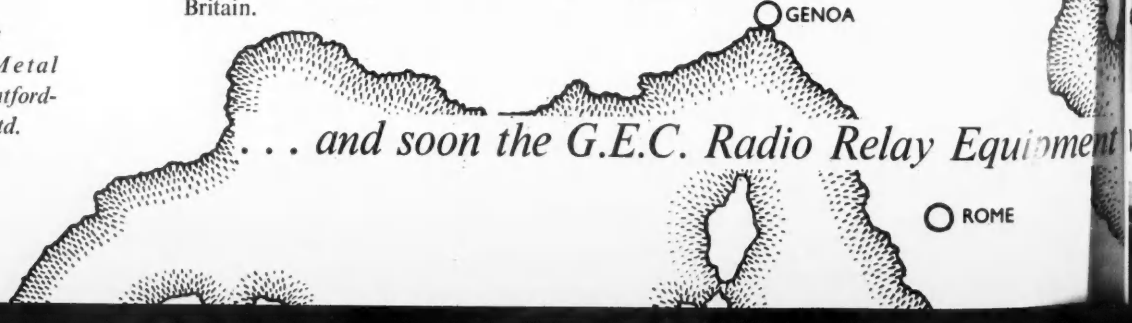


In addition, the G.E.C. supplied to the B.B.C. the 2000 Mc/s equipment to form reversible links between Wrotham and Cassel to link the British Isles to the Continental television network.

G.E.C. line transmission and radio relay equipment also bring B.B.C. and international television to the south-west, midlands and north-west of Britain.

Installed by Hasler S.A. (Berne)

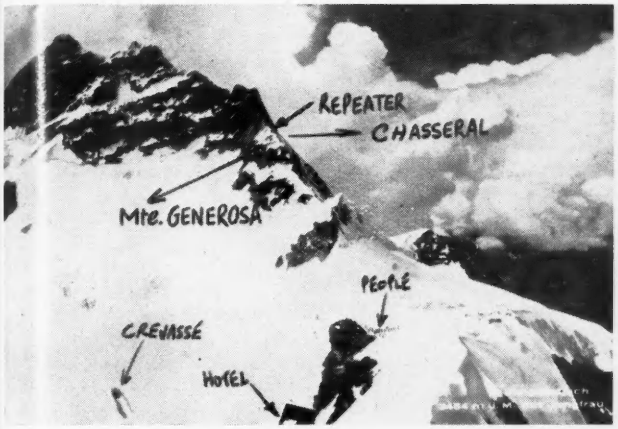
Paraboloids by Precision Metal Spinnings (Stratford-upon-Avon) Ltd.



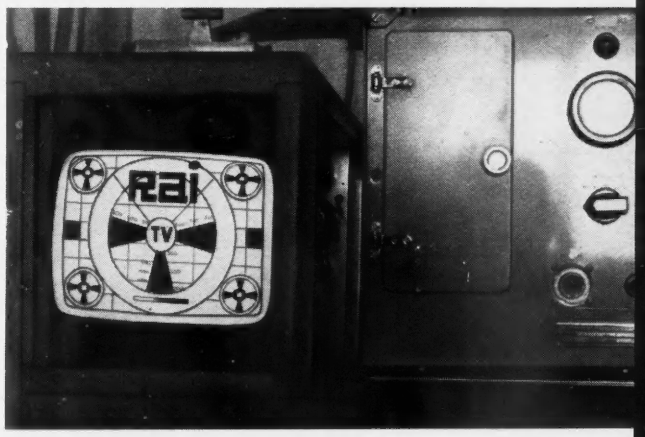
. . . and soon the G.E.C. Radio Relay Equipment will

le by G.E.C.

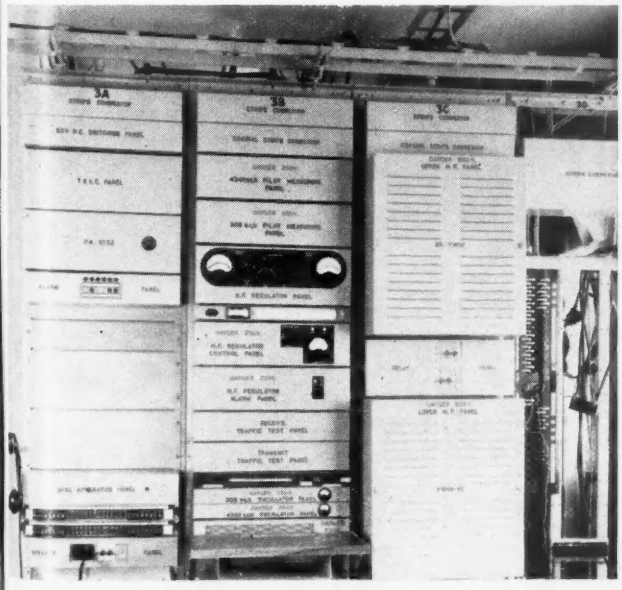
Snow and ice failed to delay the rapid installation of the G.E.C. aerial which faces Chasseral at the Jungfraujoch.



This view was sent to G.E.C. by the Company's installer, and illustrates the difficulty of establishing the relay station at 12,000 ft. on the Jungfraujoch.



The first picture received over the G.E.C. television link in Switzerland, from Rome, was sharp and clear.



Terminal equipment at the Wenvoe end of the G.E.C. London–Wenvoe link.

Birmingham terminal tower in the G.E.C. London–Birmingham link.

ment will *bring Television to Norwich*

THE GENERAL ELECTRIC COMPANY LIMITED OF ENGLAND
Telephone, Radio and Television Works
COVENTRY, ENGLAND

Switchboard Watchdogs

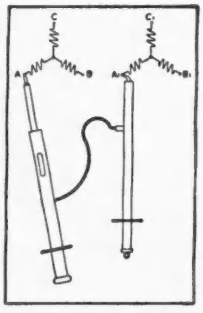
Install Brush H.R.C. cartridge fuse links to stand guard over your valuable electrical plant. These watchdogs—tireless thoroughbreds—never sleep. If a heavy, damaging fault current tries to slip past they snap it off well before the peak is reached. Voltage rise is negligible. A special shunt wire indicates the particular fuse which made the kill. The Brush H.R.C. fuse link range covers current ratings from 2 to 300 amperes and is to British Standard dimensions. Ask for the complete pedigree in Publication No. 81002.

H.R.C. Fuse Links by **BRUSH**

BRUSH ELECTRICAL ENGINEERING CO. LTD., HOPKINSON WORKS, CARDIFF, GREAT BRITAIN

B.31/1

BIRMINGHAM • BRISTOL • GLASGOW • IPSWICH • LEEDS • LONDON • LOUGHBOROUGH • MANCHESTER • NEWCASTLE • SHEFFIELD



IS IT ALIVE ?

PHASING RODS to locate interconnections between two A.C. systems.

VACUUM TUBE DETECTORS

Range : 1,500 to 35,000 v.

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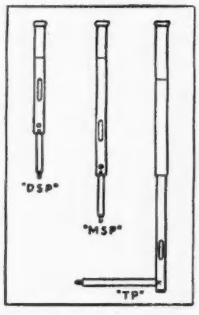

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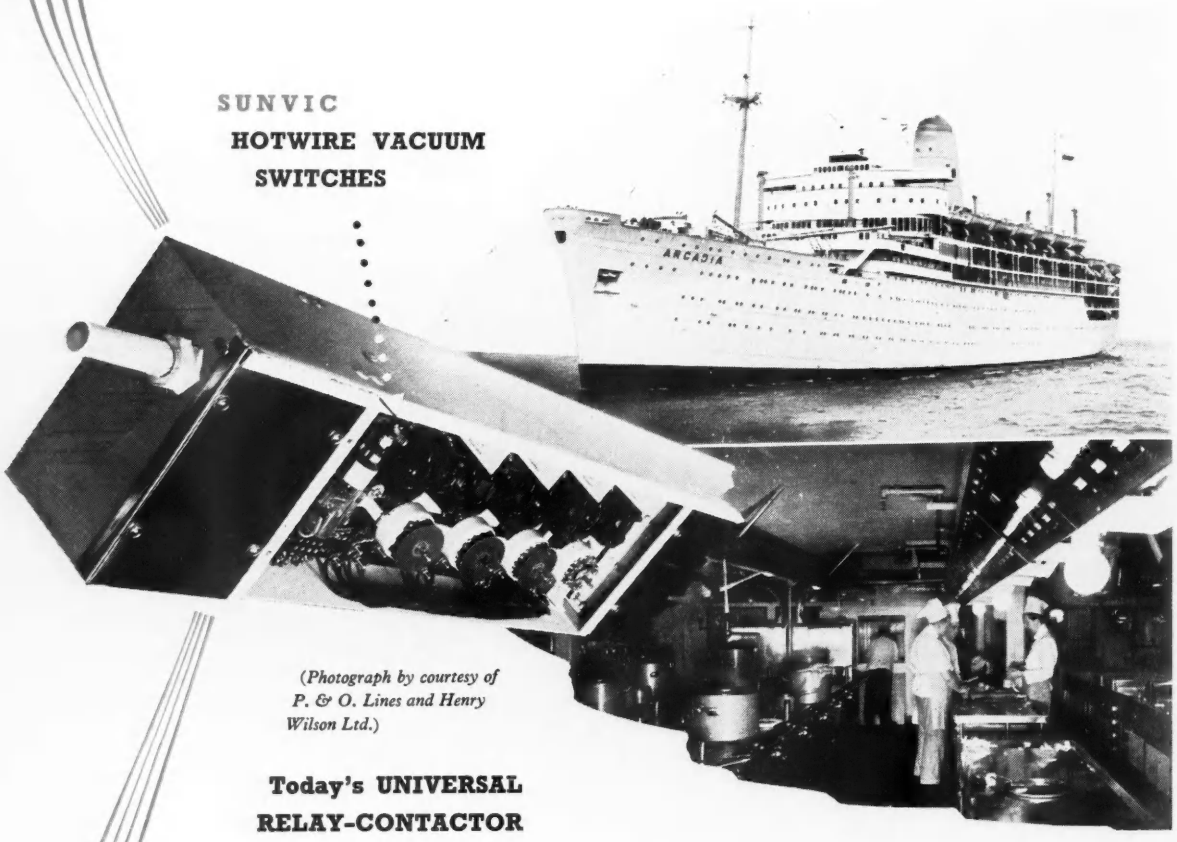

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Today's UNIVERSAL RELAY-CONTACTOR

The controls for the 18 ovens in the galley of S.S. "Arcadia" incorporate Sunvic Hotwire Vacuum Switches. Another example of the use of Sunvic instruments where reliability is essential. H.V.S. relays are used in many such applications where long, trouble-free service is of vital importance—at sea (protection of fresh water supplies), in the air (de-icing equipment) and on land (from approach radar to thermostatically controlled cots for premature babies).

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Two mouldings made from acrylic plastics house the mechanism and a generous supply of solder. Careful design of the mouldings, by our product design department, has reduced the time taken for assembly to a minimum and eliminated costly operations on the metal parts. Production of the mouldings is carried out at our Walthamstow factory, where design and development engineers are always ready to advise about the application of moulded plastics to industrial uses.

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Flying Repairs. Repairs from overseas are not infrequent at the house of Collins. The above photograph shows two rotors, which had just arrived by air from the Middle East, being unpacked. A few days later they were again in B.O.A.C.'s charge on their urgent way back to another satisfied customer.

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9 & 11 Featherstone Road Southall
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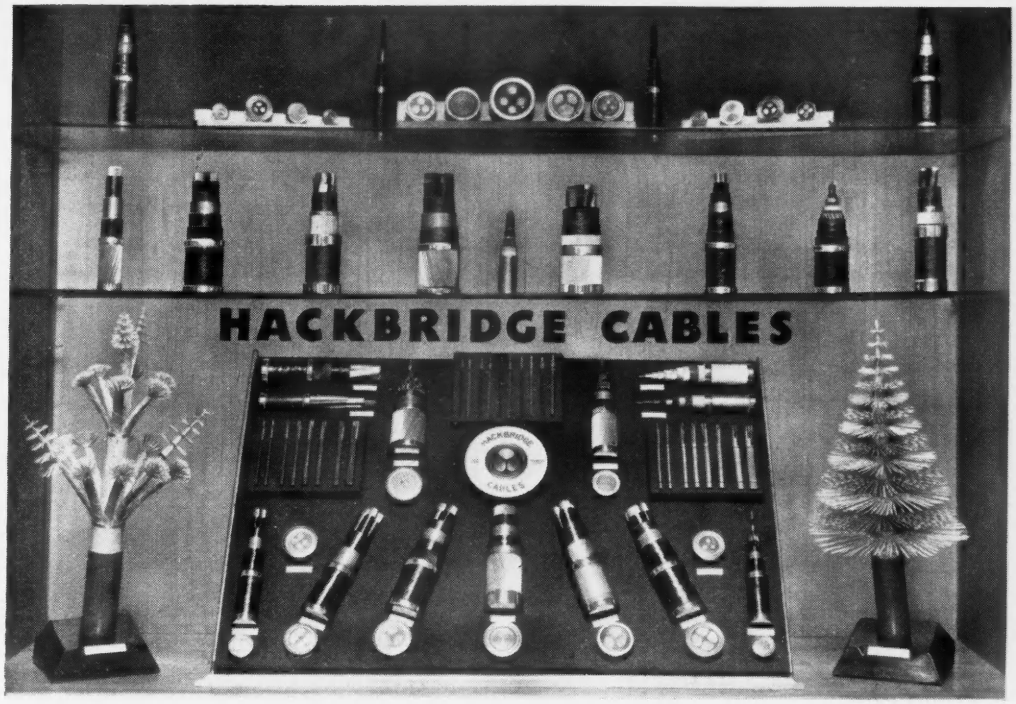

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The strange case of the varnished nylon

On reflection, I submit, not so strange as one would think. This young lady is about to leave for equatorial Africa where, as I understand, the Varnished Nylon manufactured by our good friend Symons is particularly trustworthy. Indeed, under tropical conditions anywhere it combines mechanical strength with excellent electrical properties. It has, you will observe, two very notable features. First, it is unique in that as a straight cut tape it is sufficiently extensible to replace bias cut tape in many applications. Second, it has a far higher insulation resistance under humid conditions than any other varnished fabric. A pretty case and a pretty client, if I may say so.

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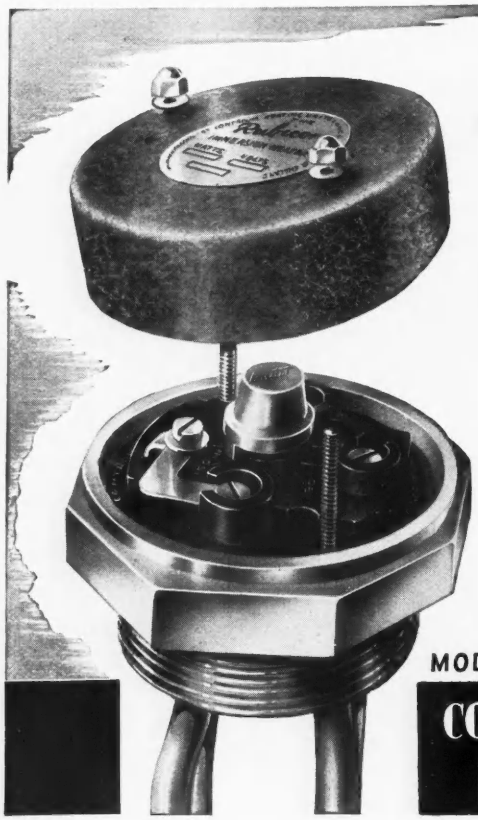

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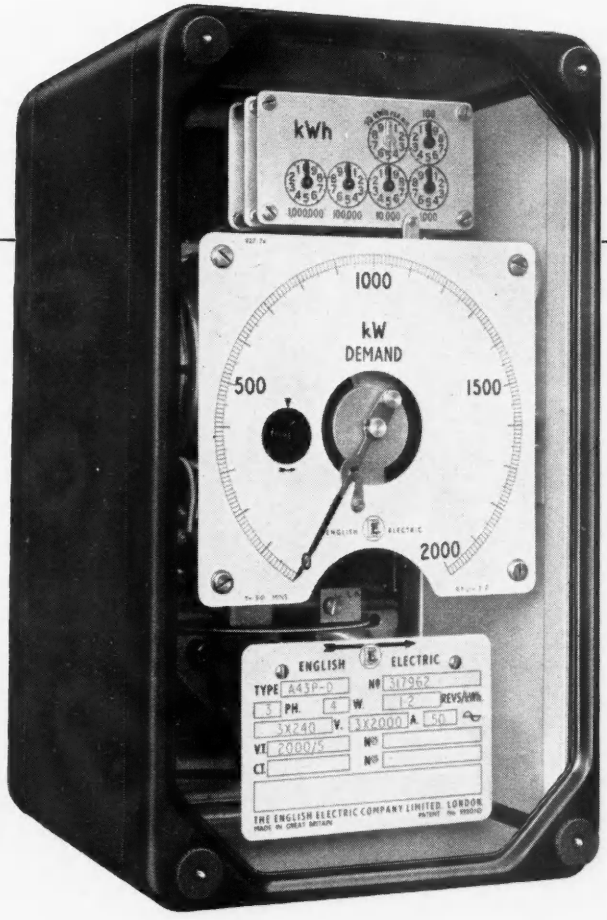

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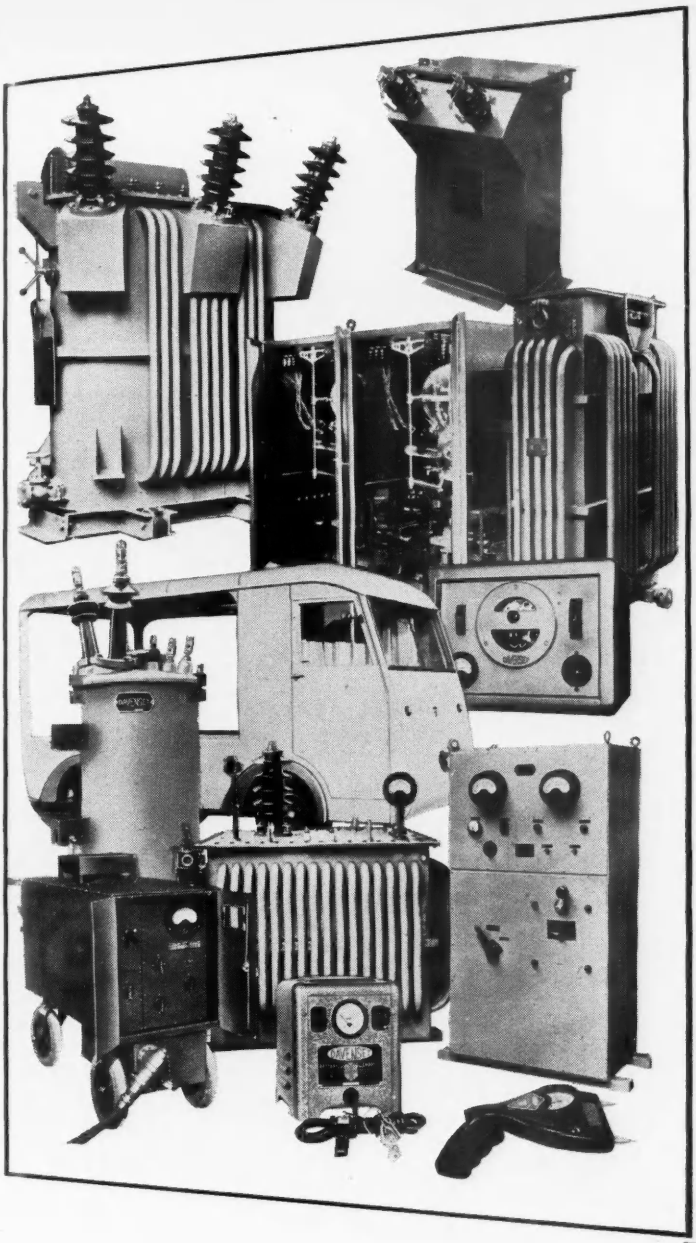

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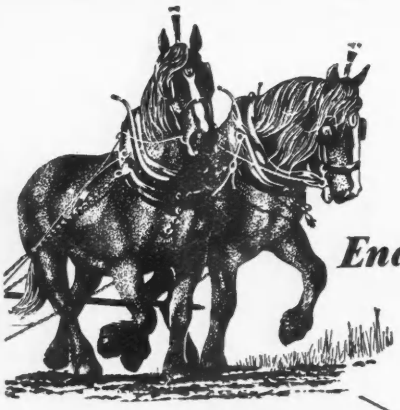

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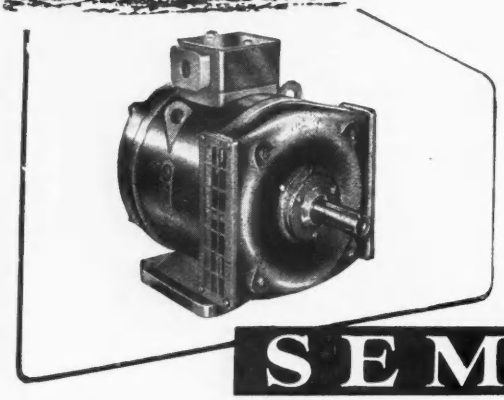

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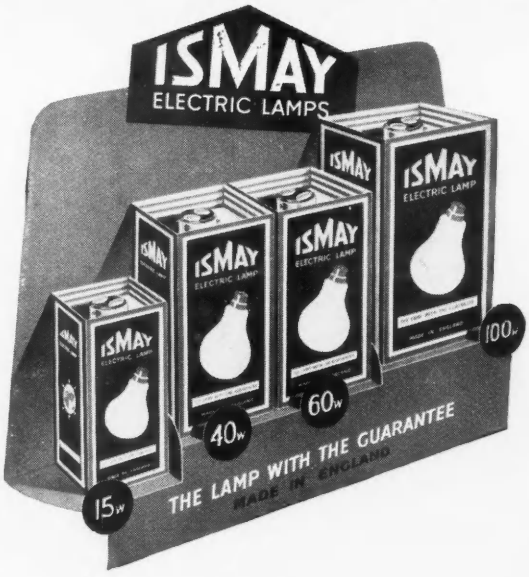

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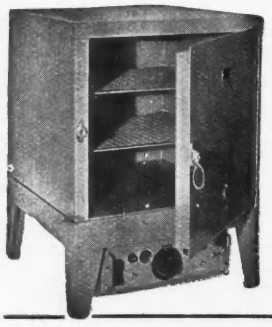

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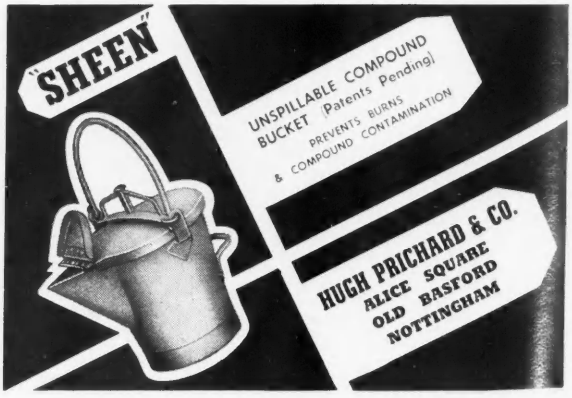

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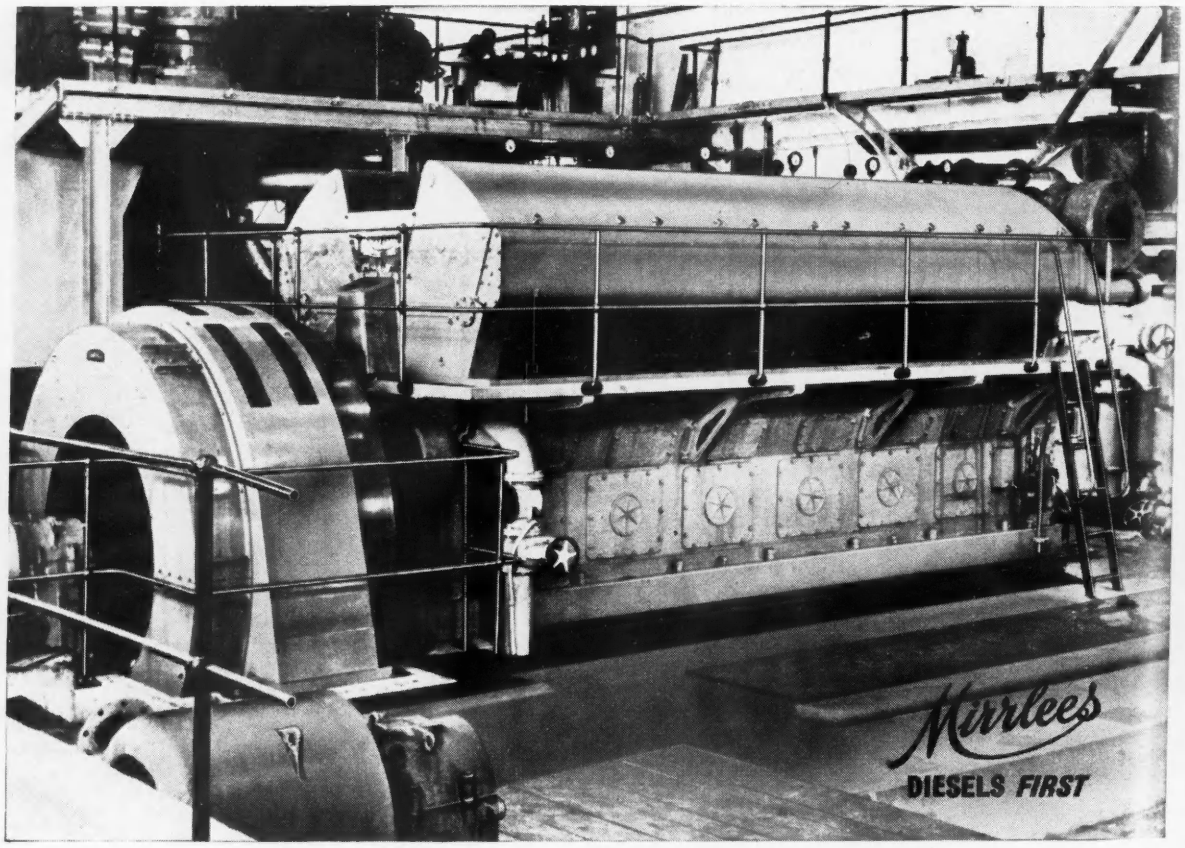

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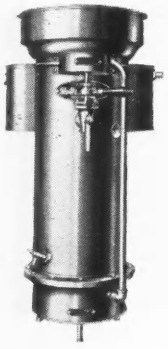

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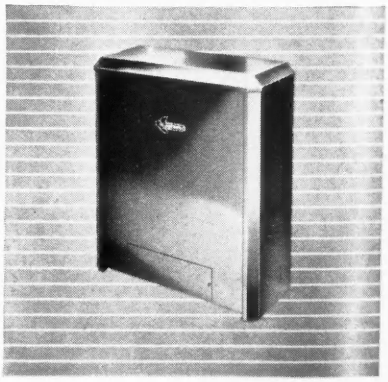

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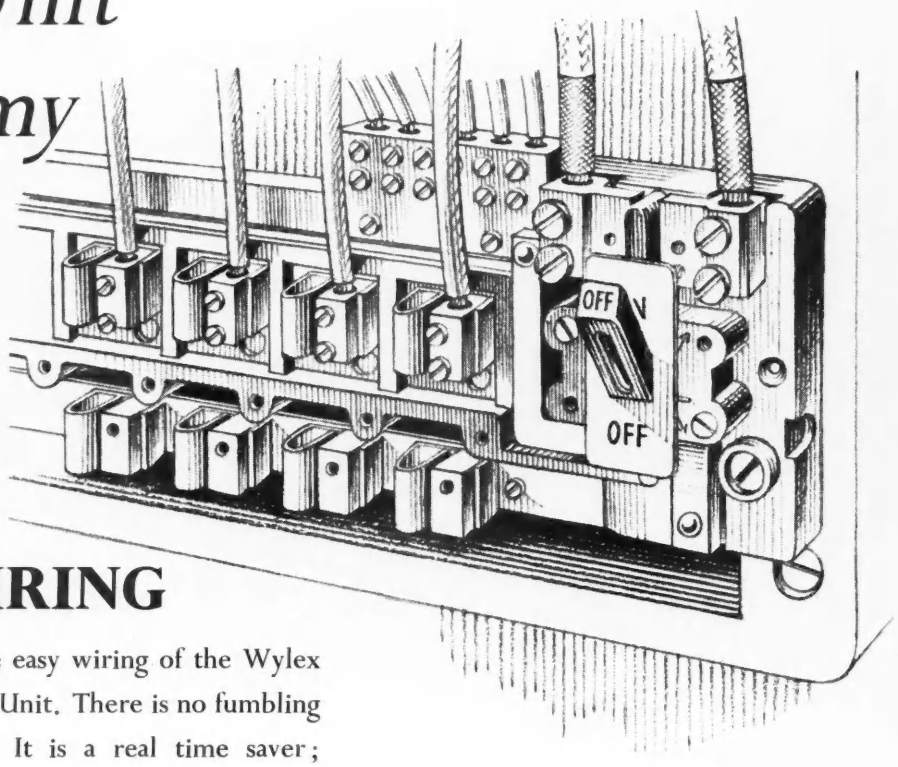

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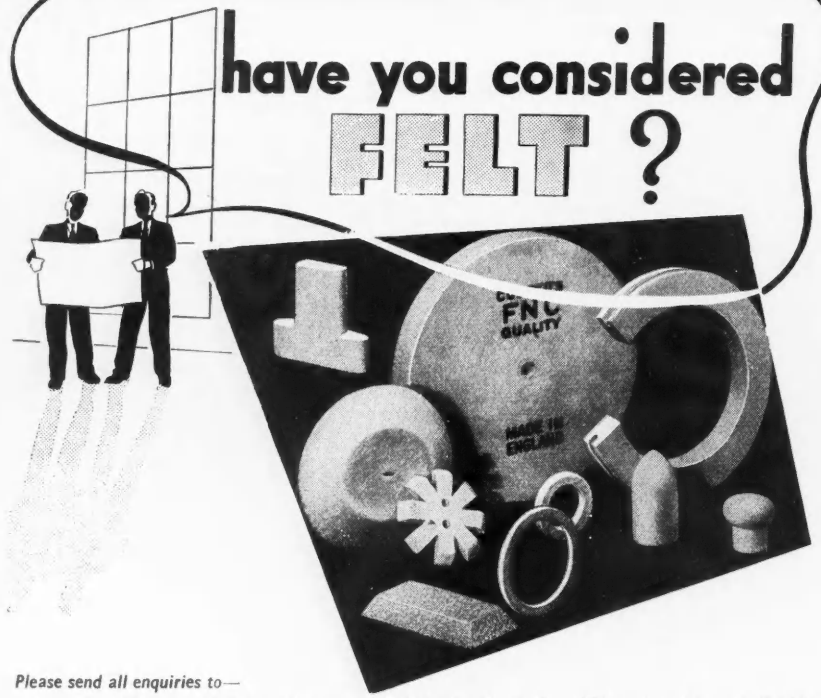

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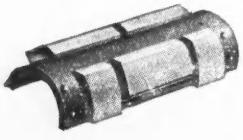

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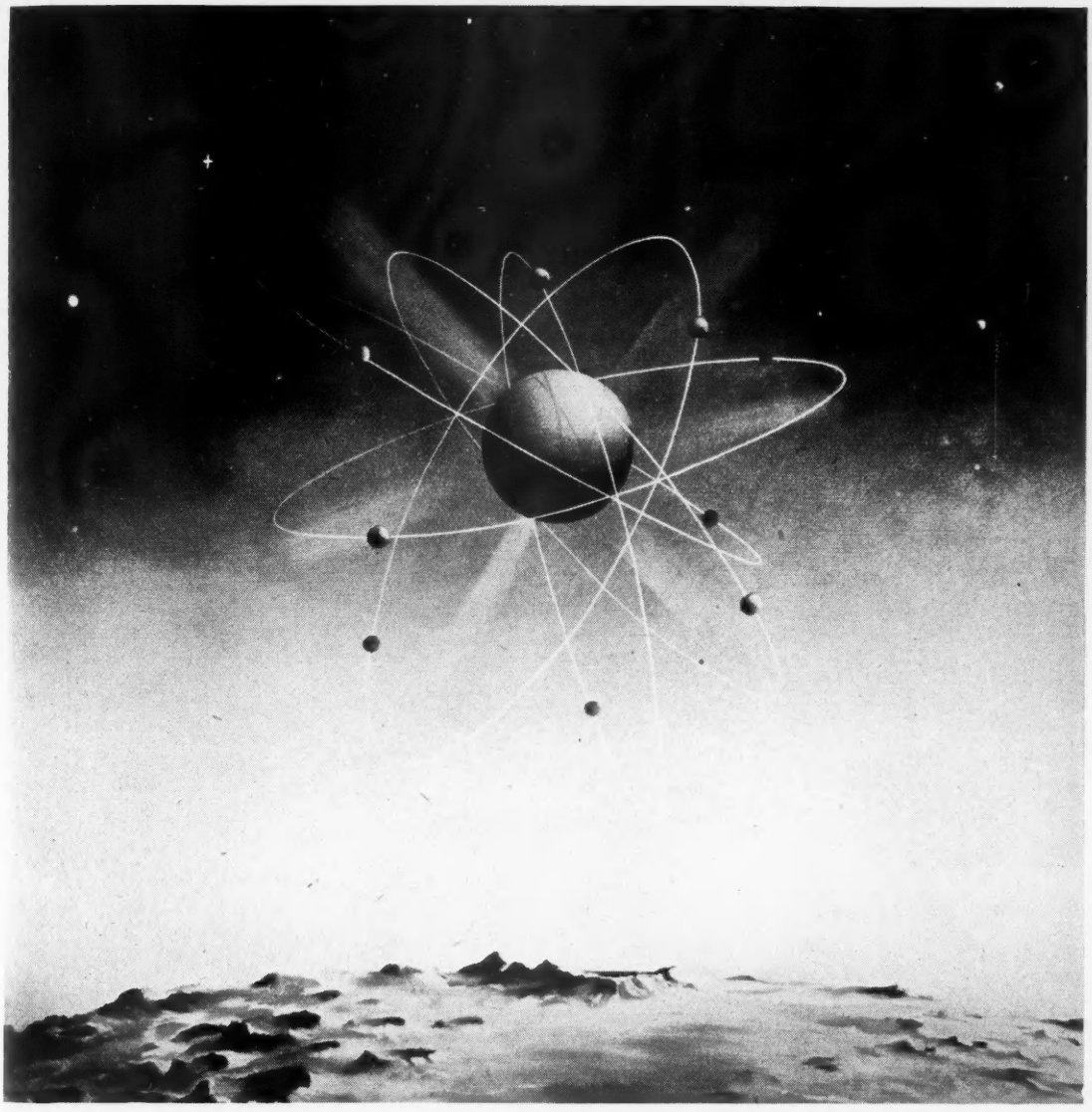

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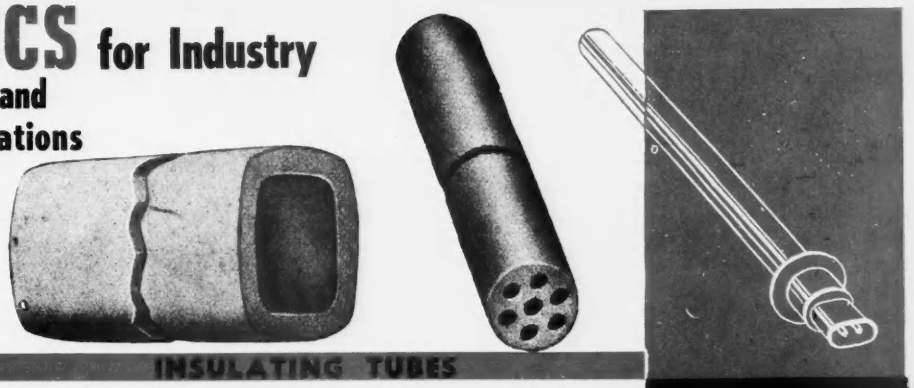

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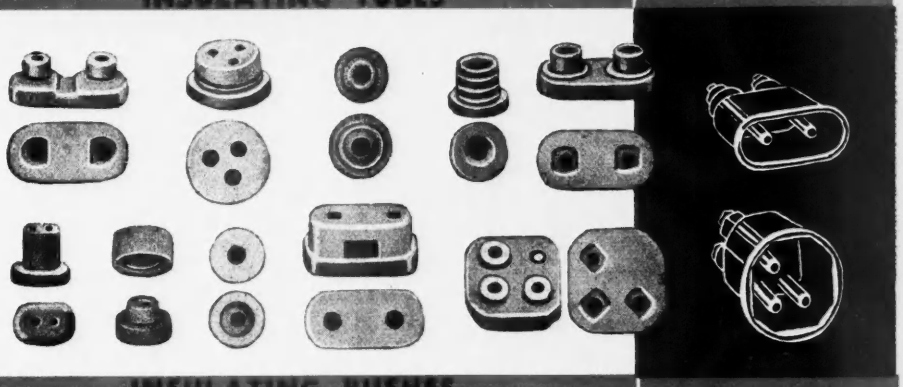

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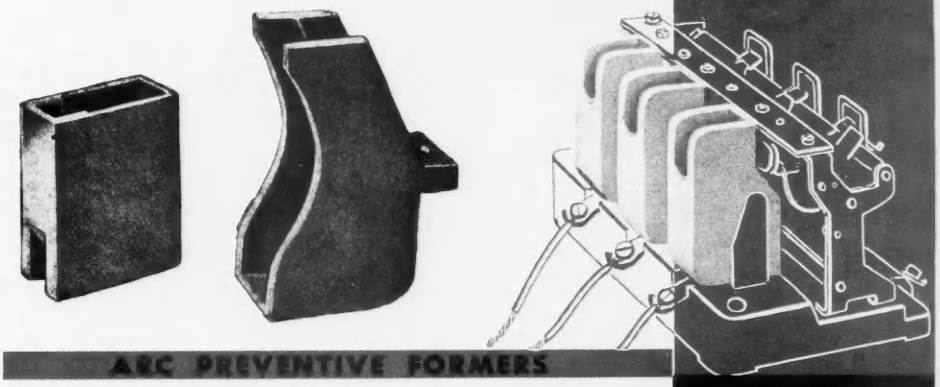

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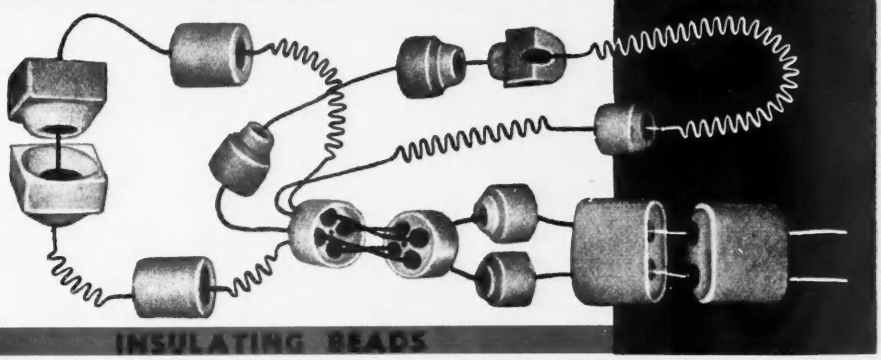

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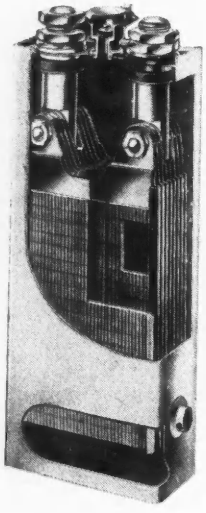

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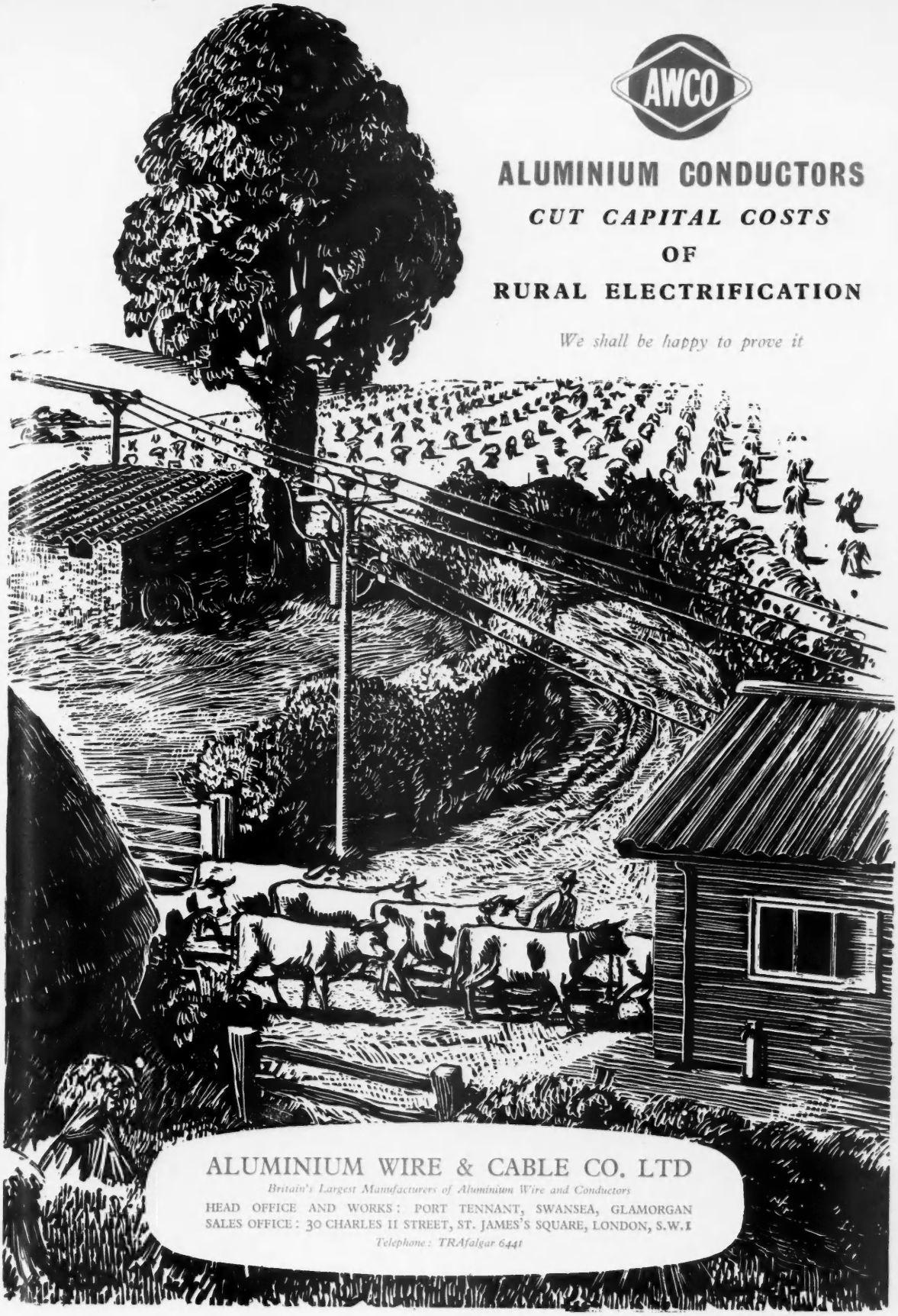

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Uses increasing for New-type Mesh Metal

ADAPTABLE & ECONOMICAL

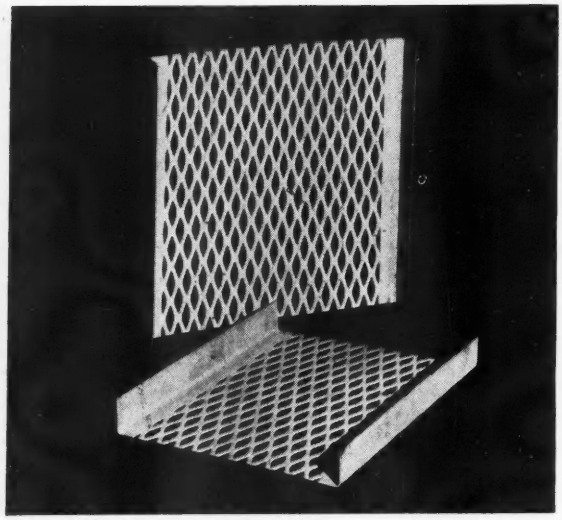
NEW uses for expanded metal are being discovered daily. The following are only a few of its many applications:— Safety guards for all kinds of machinery, radiators, trees, windows, ventilators, fires, etc. Racks and shelves, industrial trays and baskets, storage bins: air filters; backing for insulating materials; poultry cages; pallets and stillages; balcony balustrading; litter baskets; partitions and enclosures. Indeed, hundreds of widely different types of articles are now better and more easily made with Expanded Metal, now available in two new forms: Flattened "Expamet" and Safe-mesh "Expamet".

What is Expanded Metal?

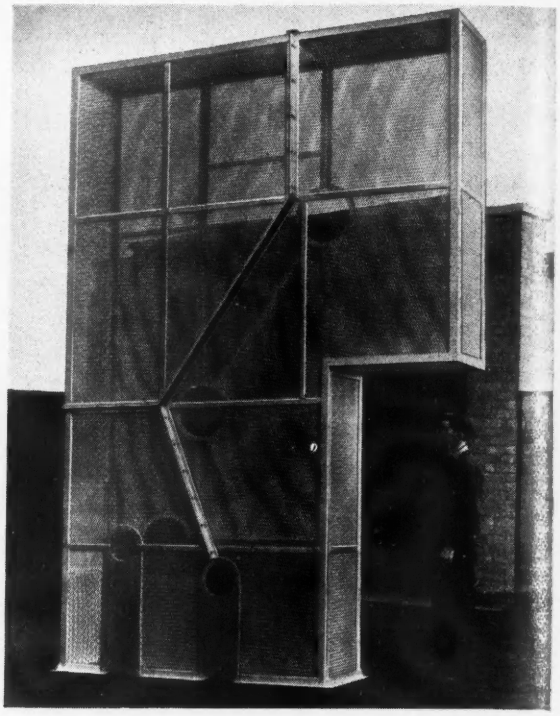
Expanded metal is made from a solid sheet of rolled sheet metal—steel, stainless steel, aluminium, brass or copper. It is cut and expanded without any waste of material into a network of diamond shaped meshes. The finished meshwork is strong and durable; it is easy to work, weld and shape; it has a naturally decorative appearance and is suitable for most of the available finishing processes.

Two New Types

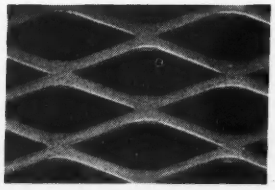
The two new basic ranges of expanded metal which are now on the market are — Flattened and Safe-mesh "Expamet". The first, Flattened "Expamet", is made by brushing and pressure-rolling the strands and junctions of Expanded Metal, so as to obtain a flat, smooth and level surface. The other, Safe-mesh "Expamet", is a range of meshes which have been brushed to remove all burrs and rough edges.



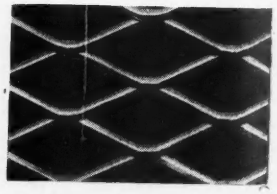
Cable trays *made from Flattened "Expamet".*



Machinery Guards *Machinery guards are one of the many uses for Safe-mesh "Expamet". The above were made by the City Sheet Metal Works, Ltd., Leicester.*



Flattened "Expamet" *The above illustration shows an example of Flattened "Expamet". This is made in thirteen different weights and mesh sizes from 5/32" to 1½" (shortway of mesh).*



Safe-Mesh "Expamet" *Pictured above is Safe-Mesh "Expamet" which is produced in eight standard weights, and in mesh sizes from ¼" to 1½" (shortway of mesh).*

Can it Help You?

Adaptable, economical and long lasting — there are an infinite number of uses for Expanded Metal. Wherever there is a gap to be filled or an article to be made with open meshwork, industry is using this very versatile material; and imaginative executives are finding new and unsuspected uses for it daily. For full information and advice, please write or telephone.

Expamet

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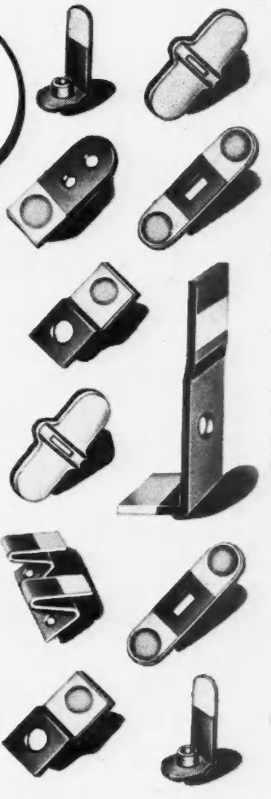

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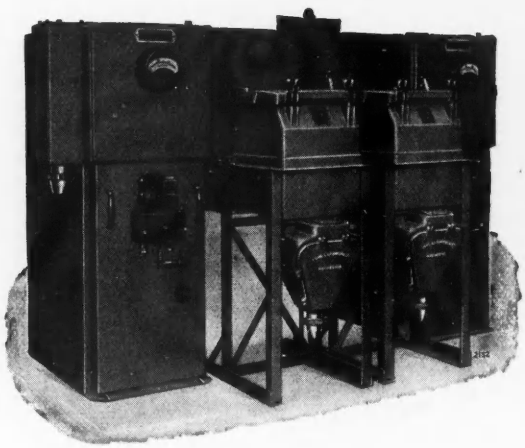

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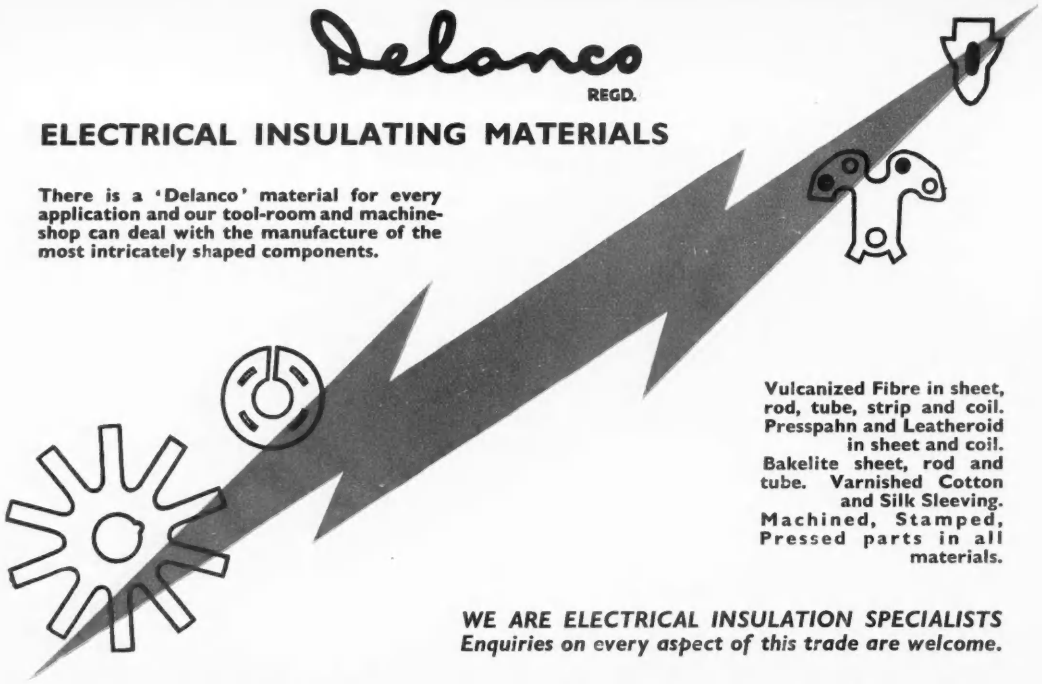

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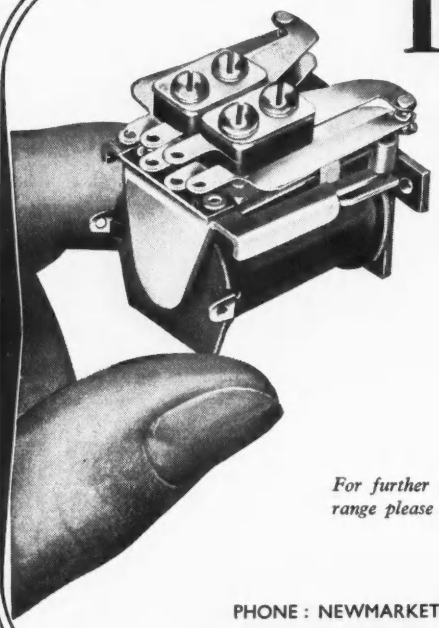

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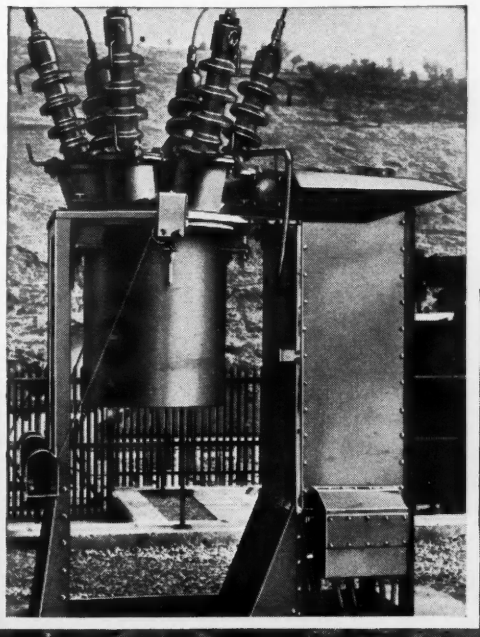

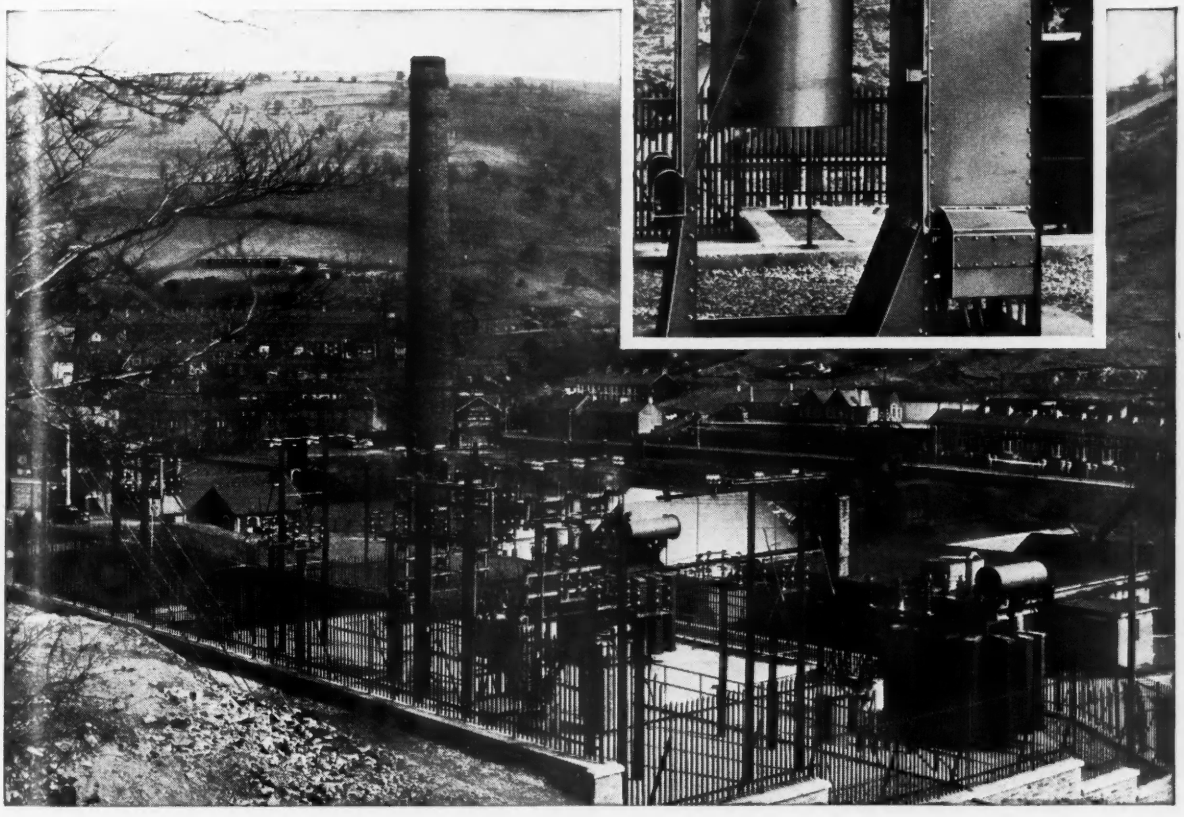

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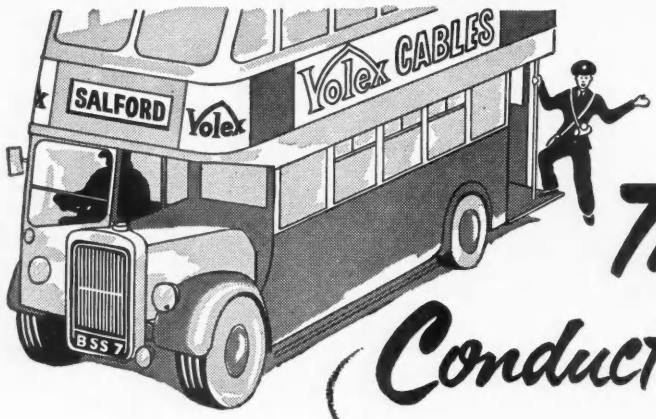

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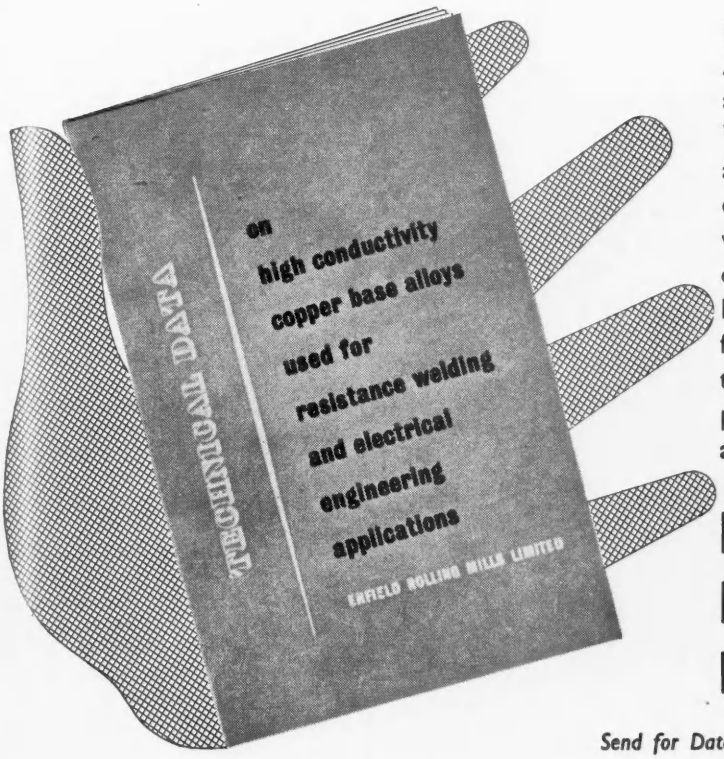

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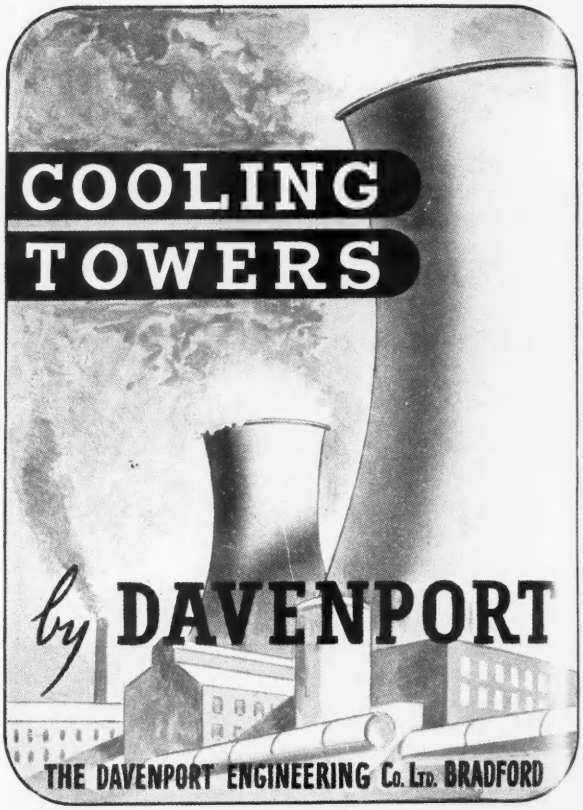

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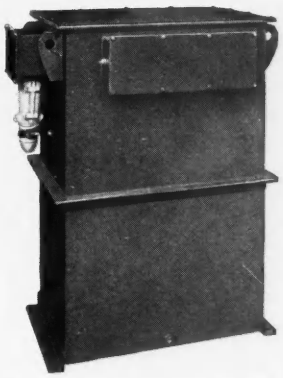

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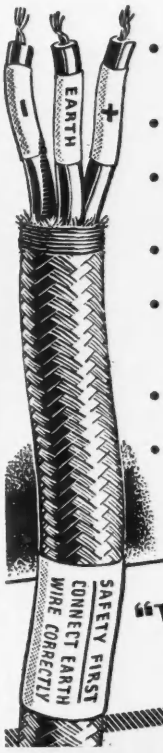

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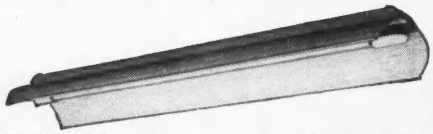

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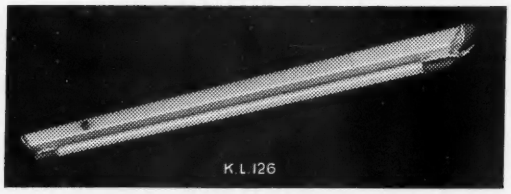

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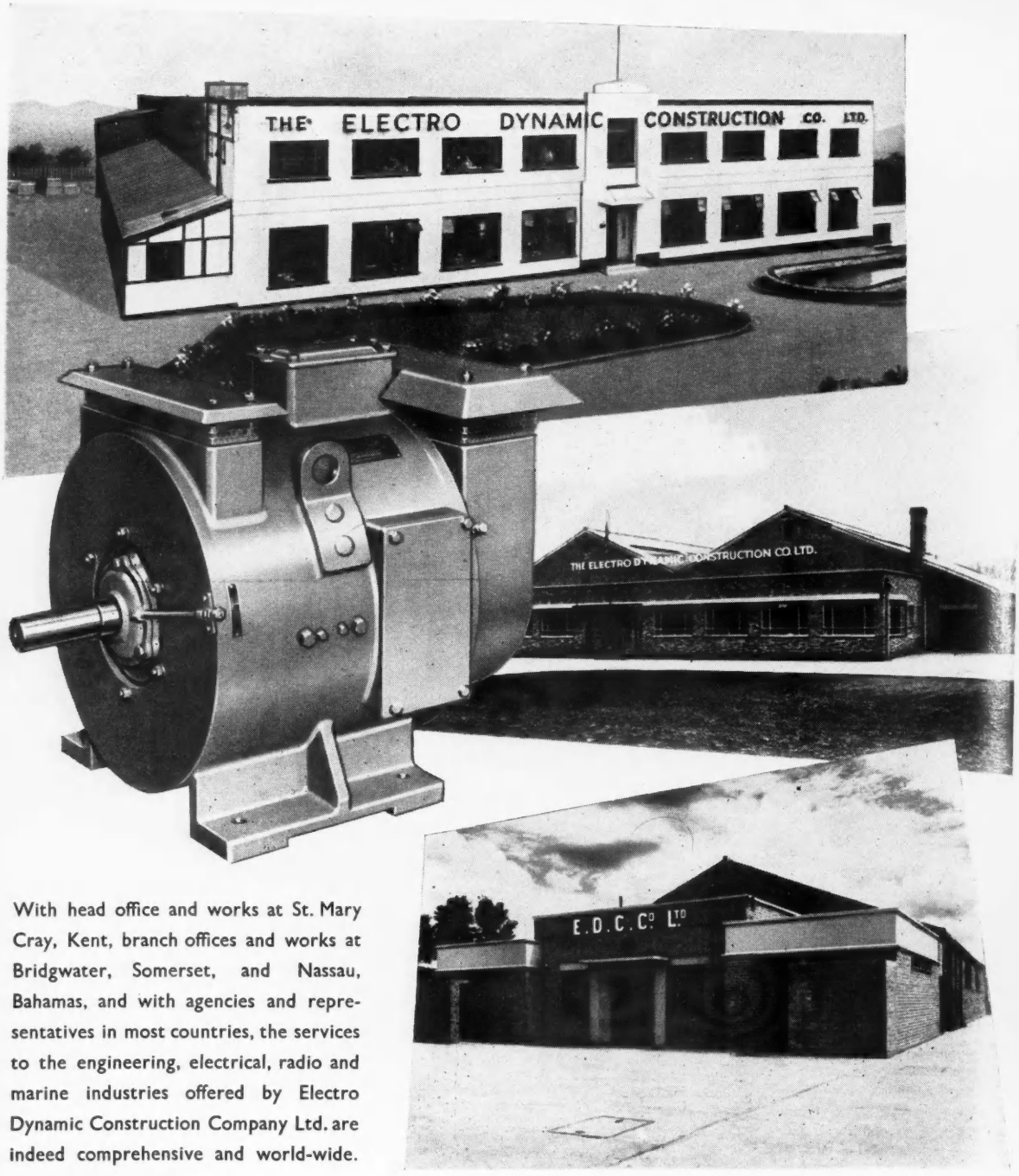

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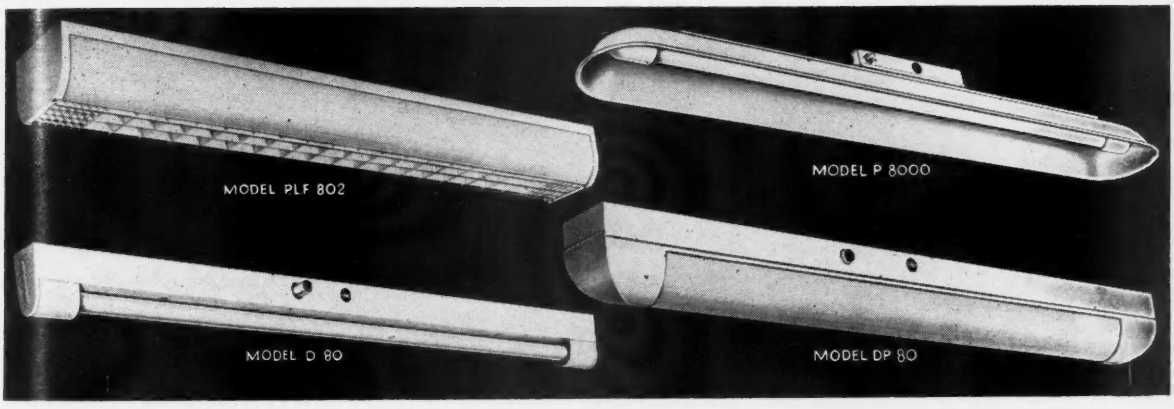

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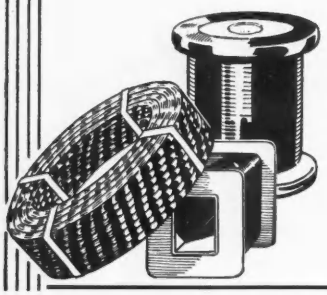

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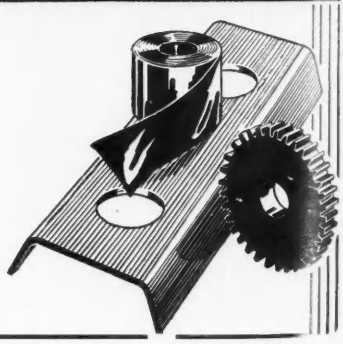

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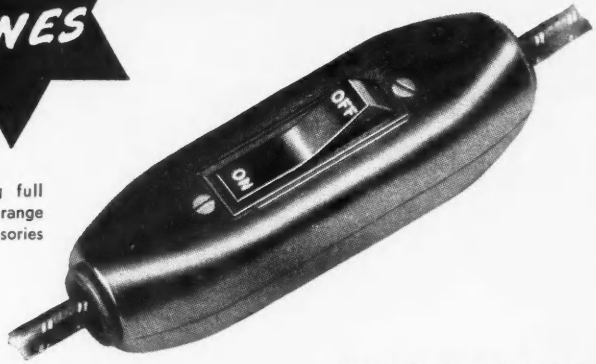

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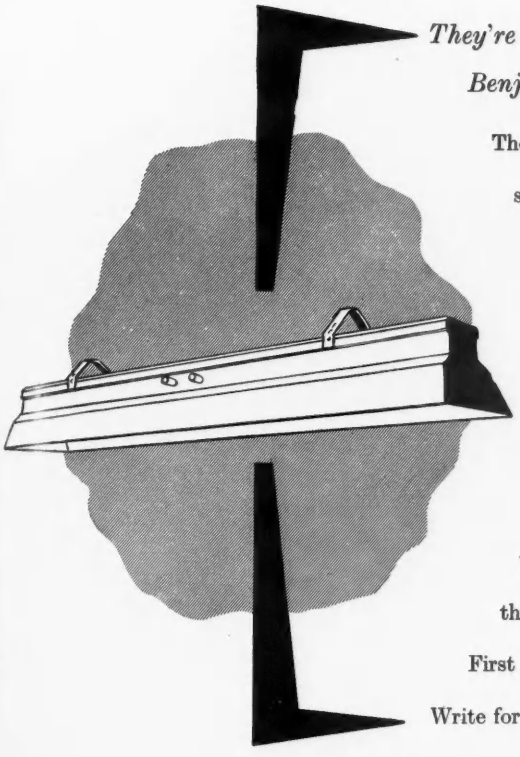

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23 JULY 1954

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VOLUME 155 ✧ NUMBER 4

Eighty-Second Year of Publication

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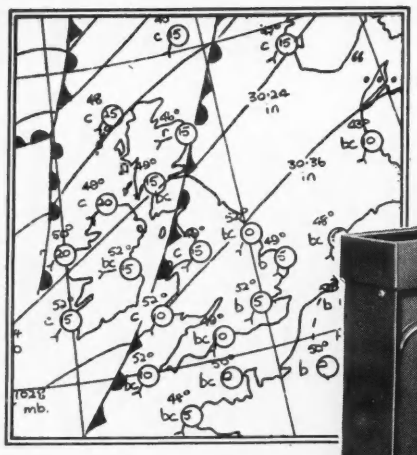
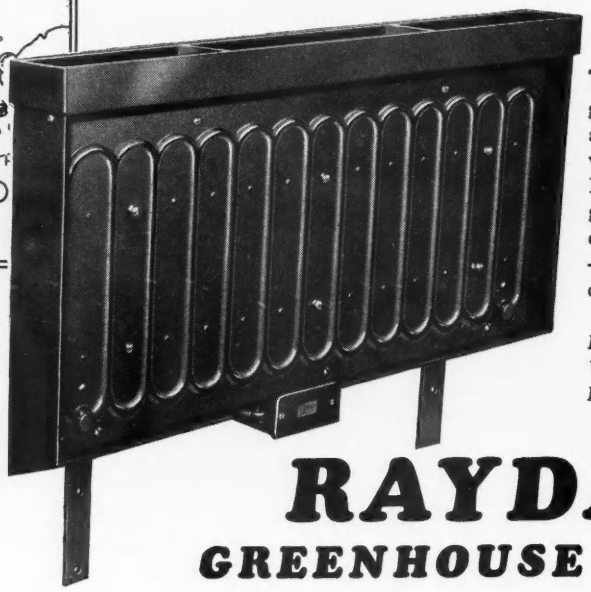


a hard frost tonight, sunny periods tomorrow, becoming milder by afternoon..."



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ELECTRICAL REVIEW

23 July 1954 Vol. 155 No. 4 Established 1872

False Atomic Predictions

MORE than once recently we have drawn attention to extravagant claims, misleading reports and loose statements which have been made about the future prospects of the availability of atomic energy for electricity generation and public supply and now, once again, we have been reading headlines such as " Atomic Power Stations Before 1960."

This latest crop of misleading statements appear to have arisen out of a remark by Mr. Geoffrey Lloyd, Minister of Fuel and Power, in the House on 9th July, when he was moving a Bill to permit gas and electricity supply authorities to raise additional capital. The relevant passage of his speech was apparently: " Developments in atomic power are progressing so rapidly that the construction of nuclear power stations of an advanced type may be undertaken before 1960." In view of the very considerable time required for the building of modern power stations this passage lines up very well with statements made a little earlier on by such authorities as Sir John Cockcroft, to the effect that public supply may be available from economic atomic power stations which are likely to be brought into operation between the years 1965 and 1970. A very different prospect, this, from the implication in " atomic power stations before 1960."

In much the same way, more recently still, the appointment of a nuclear energy engineer by the British Electricity Authority has produced all sorts of extravagant claims. The appointment is, of course, a very important one, but certain published statements would lead one to believe that the engineer in question will have far reaching executive powers. Actually it may be expected that he will be required to act in an advisory capacity in preparing the way for a nuclear energy department of the B.E.A.

It is inevitable that such a major development as nuclear energy should receive very considerable and sometimes unbalanced publicity, but this should not be allowed to create false hopes or in any way present a faulty picture of the development.

We are not haggling over the choice of words but rather making an effort to keep in true perspective events which are certain to affect every aspect of the life and development of this country to a degree hitherto unparalleled in peacetime.

Our coal is running short from the viewpoint of economic mining; atomic energy is promising but so far is not an economic development. Our future power supplies are very largely bound up with these two sources and our very existence as a nation with a high standard of living is dependent on ever increasing production and, therefore, expanding power availability.

It is thus absolutely vital to every man, woman and child in the country that the tremendous developments which are taking place and which must govern future electricity supply in this country should be kept in their true perspective all through the present and coming critical period. In all this the electrical industry has the greatest possible concern.

EASIER HIRE-PURCHASE

Particularly at this time of the year when sales of electrical, radio and television apparatus are at a low level is the removal of Government restrictions on hire-purchase schemes welcome. Hitherto the minimum initial deposit has been one-third of the purchase price and the maximum repayment period has been eighteen months. Now traders can fix any terms they desire but, as there is to be no change in the general limitation on finance for hire-purchase organizations, the extension of the facilities is likely to be curbed to some extent. It seems improbable that the general repayment period will be extended beyond two years but, while some traders are now asking for a 10 per cent initial payment, others are requiring no deposit at all. The removal of restrictions should have a particularly noticeable effect on sales of the larger appliances such as refrigerators, washing machines and television sets for which the raising of the down payment has often presented some difficulties. Further, export trade is likely to benefit by the more stable conditions created in the home market. For a long time traders have been advocating the change, which many consider will have an even more stimulating effect on sales than further reductions in purchase tax.

NEXT YEAR'S CONVENTION

It will be remembered that when it was announced at Eastbourne last month that next year's British Electrical Power Convention was to be held at Margate there was some dissension. Two speakers expressed the view that Margate did not offer the facilities and amenities which delegates required, but this was contradicted by Lord Citrine and the opposition was withdrawn. Now we have received a brief announcement from the secretary of the Convention to the effect that, after all, the Council has decided that next year's gathering will be at Brighton and that this has necessitated altering the period to the week commencing 27th June. We think that the decision will be generally approved; it would have been unsatisfactory to have had any doubts which might have militated against the success of the Convention.

UNIONS AND PRODUCTIVITY

That some misconceived ideas exist on who will or will not benefit from increased productive efficiency is shown by the experience of the Tyneside Productivity Committee. Under a scheme it has sponsored and in which a number of electrical and general engineering firms are taking part it is proposed to arrange interworks visits by teams representing management, technicians and workers who would then be invited to make suggestions for raising output. The A.E.U. Tyne Committee, however, has refused to take part, Mr. L. E. Edmondson, the district secretary, saying that employees had no guarantee that they would share in the increased profits through higher productivity. A more enlightened view is revealed by the publication last week, by the British Productivity Council, of a booklet "Why Productivity?" The significance of this is that it is the first time that an organization on which both trade unions and employers are represented has issued a detailed statement on the whole background of productivity. It gives a clear answer to the question "Who Benefits?" Without increased productivity we, as an industrial nation, must inevitably fall behind others, there will be less employment, costs will be higher and real wages in terms of purchasing power will be reduced.

MASS PRODUCTION

We still hear it said much too frequently that mass production often results in inferior products. This has a very special electrical significance, largely because any form of modern quantity production is only possible by means of the inimitable electric drive with its inherent "electric" control, be it straight electric, electro-magnetic or electronic, which permits not only quantity but precision production, and also because many high-quality electrical appliances and components are outstanding examples of mass production. Regarding the latter aspect, what better example of mass production can we find than the ordinary electric lamp, with its semi-moulded, semi-blown bulb produced on the modern rotary lamp making machine? Then there are the ever-increasing range of pressings and stampings for contacts and numerous other components which can be produced on mass production lines only because of their high quality metal (and hence machinability) which is brought about in the early stages of the metal production by cold rolling which is only possible by virtue of the electric drive and its inherent precision control.

OFF-PEAK HEATING

Whether or not they have anything to do with the recent calls for load factor improvement must be a speculation, but in this issue appear references to two examples of space heating equipment or systems which are described particularly as off-peak heating equipment. A letter from Mr. A. J. Mare in the correspondence columns concerns the concrete block thermal storage heater. This takes our mind back to the very early 'thirties when the soapstone thermal storage heater formed the prime equipment of some excellent off-peak installations in this country, including that at Buckfast Abbey, Devon, and when quite a number of off-peak office installations made use of it in the densest part of London. The other reference is to low-temperature radiant floor heating installations in Scotland. These are reminiscent of the "Dulrae" and similar low-temperature panel heating systems of about the same period, and although we did not hear of floor heating in particular in those days the low temperature principle was just the same.

World Power Conference

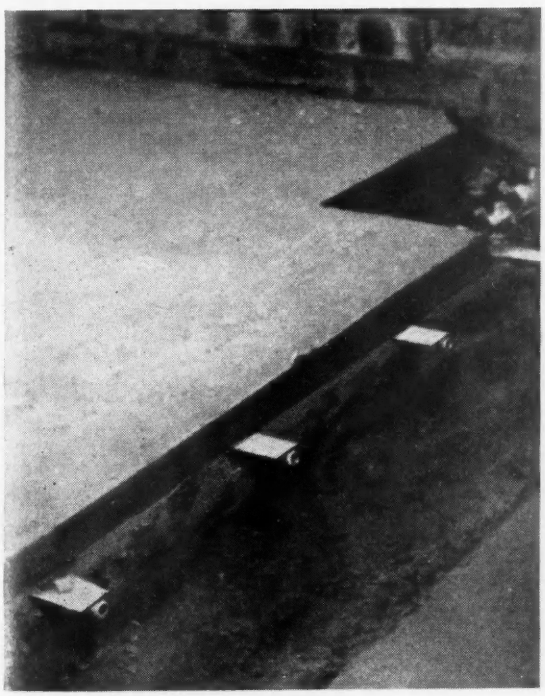
Next week's issue of the *Electrical Review* will contain a summary of the papers of special electrical interest presented at the Sectional Meeting of the World Power Conference which is being held at Petropolis, Brazil, from 25th July to 10th August

Floor partly screeded ready for final granolithic finish

Electric Floor Heating

Development of the Low Temperature Radiant System in Scotland

ALTHOUGH the low temperature radiant floor heating system is now being increasingly adopted throughout the country, South West Scotland can claim the credit for being the pioneer of this form of space heating. Development would, however, have been impossible if the former undertakers, and particularly Mr. J. Gogan, then sales manager of the Clyde Valley Electrical Power Co., Ltd., and now chief commercial officer of the South West Scotland Electricity Board, had not encouraged the load by devising a suitable and acceptable off-peak tariff. It was in fact in 1944 that the prototype of the system, which has now been acquired and developed by Panelec (Great Britain), Ltd., Reigate, was first installed at the medical clinic at Colvilles' Dalzell Works, Motherwell.



Edge of finished floor screed at Heather Knowe primary school showing aluminium housings projecting into service duct (Crown copyright)

In basic design this original installation, which had a total loading of 12 kW, differed little from the present-day schemes. Insulated lead sheathed heating cables were drawn into aluminium sections, with wire netting laid over them to serve both as a heat diffuser and a key to the floor screed. To-day expanded metal replaces the wire netting and clamps are provided to secure it to the aluminium sections.

Since then about another two dozen installations have been, or are in the process of being, carried out in the South West Scotland Board's area alone, representing almost 2,000 kW of off-peak heating. The largest installation at present is that at the Babcock & Wilcox research station at Renfrew where the total heating load is 250 kW. Other buildings similarly heated include about a dozen factories, a hospital, the Royal Bank of Scotland, Kilmarnock power station canteen, the B.E.A. offices in Glasgow, the South West Scotland Electricity Board's Paisley meter testing station, Leafield Road offices at Dumfries and Woodend switching station, Helensburgh, together with five schools.

One of the latest of these school installations, that carried out at the Heather Knowe school, East Kilbride, we have had an opportunity of visiting. Here, as in some of the other more recent installations, a certain amount of wall heating has been provided to supplement the floor

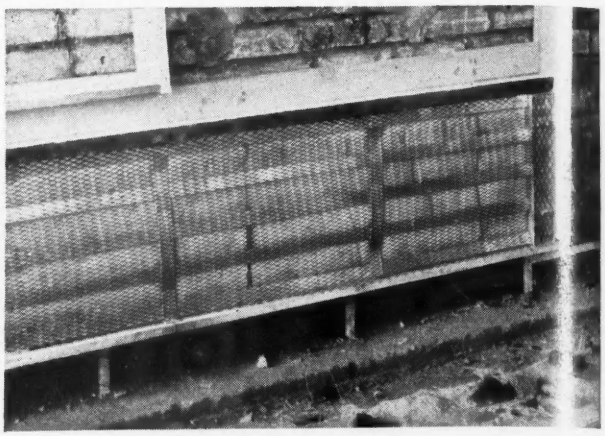
heating, the wall panelling being of precisely similar construction to that used for the floors. Actually in this case about one-quarter of the 203 kW loading is represented by wall heating.

From the " Sandamax " switch fuses in the substation the main v.i.r. cables are taken in fireclay pipes to five distribution boards (made by H. A. Macqueen & Co., Ltd.), recessed in the walls at focal points of the building. From these distribution boards Pyrotenax cable is taken to the heating cable terminals to which access is had by removing the covers from ducts running along the ends of each block. The heating cables, of which there are altogether twenty-three, run the full length of the blocks through the various partitions.

The ideal spacing of the heating cables, which have a loading of 10 W per linear foot, is considered to be one foot, giving 10 W per square foot, but in this instance a spacing of 8½in has generally been adopted. This is because the prefabricated construction of the building provides for the strengthening of the two 4ft end panels with aluminium, so preventing the heating cables from passing through them. The wall panels, which generally extend beneath the windows, measure 19ft by 2ft 3in and have a loading of 750 W each. Expanded metal is again employed to spread the heat. Two panels are installed in each classroom and, unlike the floor heating (which is switched on by Venner time switch only at off-peak periods) are, for psychological reasons, hand controlled by regulating the temperature as desired by Maclaren thermostats.

Apart from the question of efficiency and economy it is true to say that without the use of electric floor heating it would have been impossible to have carried out the erection and equipment of the school in such a remarkably short time. Actually it took only a year to carry out the construction and installation for the whole building comprising 21,000 sq ft of floor area, with seventeen classrooms for 655 pupils. The electrical contractors, who were also responsible for the electric lighting, water heating, public address systems, etc., were Osborn & Hunter, Ltd. Mr. James Primrose, of Ramsey & Primrose, acted as consulting engineer for this and most of the other floor heating installations carried out in the Glasgow area.

Shortly after the nationalization of the electricity supply



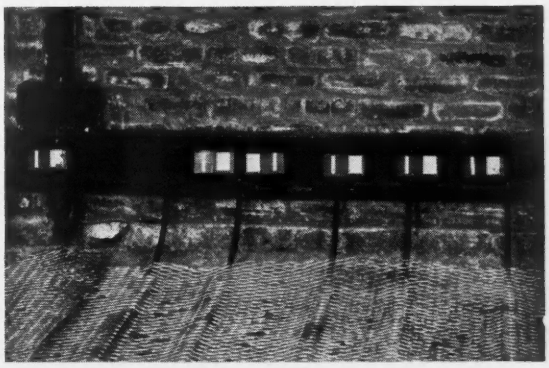
Wall panel on a gable wall ready for plaster finish at Heather Knowe school (Crown copyright)

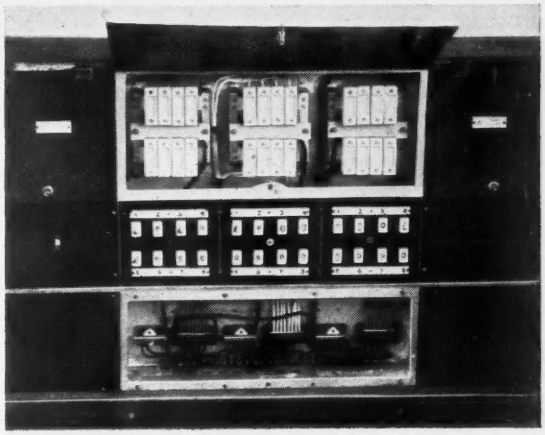
industry, the newly formed South East Scotland Electricity Board looked into this form of heating and rapidly developed it as an entirely " off-peak " load. One of the original schemes in South East Scotland, carried out in 1949, was a highly successful installation for an Edinburgh industrial concern. This installation has a load of 31 kW. This was rapidly followed by a 285 kW installation in two adjoining buildings comprising a workshop, stores, and ancillary offices. Since then twenty-four other installations, comprising five schools, a fire station, offices, a health centre, private houses, and a block of flats, have been, or are being, undertaken, and the total " off-peak " electric floor heating load in South East Scotland is now over 3,200 kW.

The largest completed scheme of this kind is at St. Mungo's Roman Catholic School, Falkirk, where the first section of the school has been finished with a loading of 410 kW. When complete the building will have a total floor warming load of 606 kW. These figures do not include the " off-peak " electrical water heating load. A still larger installation is at the new Fife County Council

Wall trough, cable housings and expanded metal ready for screeding at the S.E. Scotland Board's East Carmuirs stores garage

Fixing expanded metal to the aluminium housings before floor screed is laid at Heather Knowe school (Crown copyright) Distribution boards are recessed in the walls at focal points, as shown in the lower right-hand picture





Wall trough with ⅝in conduit bends from cable housings at the S.E. Scotland Board's East Carmuirs stores garage (top right)

Offices at Cupar, which when complete will have an electrical floor heating load of 650 kW.

The Board, in conjunction with the British Electricity Authority Research Laboratories and the Electrical Research Association, is carrying out long term research on these heating installations and also on such matters as the effect of heated floors on floor coverings. The Board has fully instrumented several of the buildings, and continuous temperature and other records are being taken with the assistance of recorders.

From experience gained in South East Scotland, Mr. J. W. Moule, chief commercial officer of the S.E. Scotland Electricity Board, in April read a paper to the E.D.A. Conference in London. In this he dealt exhaustively with the whole subject of electric floor heating, including details of technical characteristics, an analysis of a building's heat requirements, a description of the actual design of installations, and a comparison of capital and operating costs in relation to those of solid fuel heating. Generally speaking the larger the building the more favourable are the conditions for electric heating. As no boiler, boiler house, chimney, pipework, coal storage, etc., are required, the average " Panelec " system involves only about two-thirds of the capital cost of a central heating system or considerably less if the heating cable is buried solid in the earth.

While the operating costs for fuel alone may be more for electricity than for solid fuel, it will be found that, when repairs and maintenance, loan interest, depreciation and insurance are taken into consideration there is likely to be a balance in favour of electricity. This balance is particularly marked in relation to buildings, such as hospitals which require heating twenty-four hours a day. Electric floor heating lends itself to complete off-peak loading and as such it is possible to give an attractive tariff.

For assistance in the preparation of this article we are grateful to Mr. Gogan, Mr. Moule and their staffs and also to Mr. J. S. A. Primrose.

ARC CONTROL DEVICES

IN the article " Arc Control Devices," by Messrs. W. A. McNeill and P. G. H. Crane, which was published in our issue dated 9th July the wrong oscillogram was included for Fig. 7. While the oscillogram corresponds to Test No. 540218-16 in Table I, the authors point out that they should have supplied us with the oscillogram for Test No. 540218-19 since this is referred to in the text on page 48. More important, however, the particular point made concerning peak pressure occurring before the final current loop is not actually apparent on the oscillogram used. The correct oscillogram for Fig. 7 is reproduced on the right.

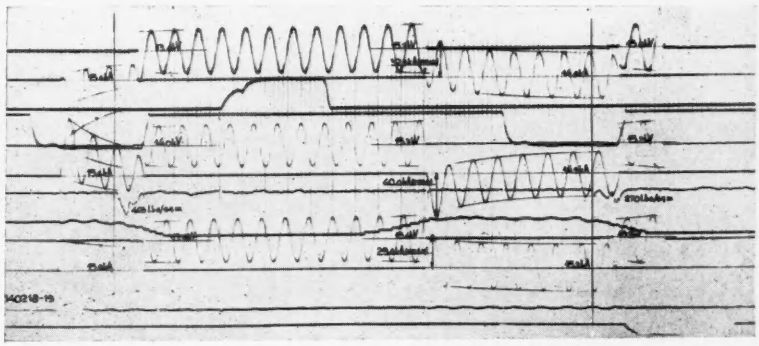


Fig. 7—This shows the maximum peak of pressure occurring before the final current loop

VIEWS on the NEWS

By REFLECTOR

THE publicity value of motion in displays I have appreciated for a long time but not until last week did I realize the importance of noise. While I was looking at the South Eastern Electricity Board's exhibit at the Sussex County Show at Eastbourne one of those periodical occasions occurred when the number of visitors to the stand had dwindled. Whereupon Mr. E. C. Claydon, the Board's agricultural engineer for the East Sussex and South West Kent Sub-Area, switched on the motor of a pneumatic grain conveyor. The effect was almost magical and within a matter of seconds the hum of the machine had brought a large crowd surging around to inspect this and other exhibits. Incidentally the apparatus in question had been ingeniously adapted by the Board to give a certain amount of drying, tubular sheathed grill boiler elements being found very convenient for the purpose.

* * *

Having been to quite a few electric cooking and other demonstrations recently, I have found it interesting to compare the different methods of approach and try and assess their relative values. The dramatized and "stunt" type of presentation, in which electric cooking is made to appear either something of an adventure or, at the opposite extreme, so easy as to require practically no attention, has obviously its uses for attracting an audience but once the "act" has been seen it quickly loses its appeal for subsequent occasions. Straightforward demonstrations, on the other hand, while less spectacular, can always be relied on to attract the public if the presentation puts the matter in its correct perspective and shows the housewife in a practical way how electric cooking can help in her particular catering problems. These demonstrations, I feel, should be as free as possible from extraneous distractions. For instance, it cannot help, I am sure, when a demonstrator is preparing a meal, for the showroom display staff to show its electrical skill in making the light outside the false kitchen window change periodically in a matter of seconds from dusk to dawn and back again.

* * *

The other day a Fleet Street business man complained in the *Evening Standard* that he was given an estimate of £18 by the London Electricity Board for putting a power point in the office premises to which he had moved. This, he commented, "brings home to one the blessings of a nationalized industry." I can understand that the cost seemed high, but surely the remedy was obvious? Electrical contractors are not nationalized. Instead, he decided to sell his electrical apparatus and buy a second-hand gas fire and boiling ring, "price £2," but he omitted to mention whether the necessary gas point was already available.

* * *

Revisiting a provincial town after an interval of less than a week, I was astonished to find that in that time new fluorescent lamps had been installed on tall concrete standards. A local resident (who had also been impressed by the speed of the work) told me that holes for the columns were dug on one day and the lamps erected the next, the lanterns being first fixed to the columns which were then hauled into position by a crane. All street lighting installations are not so straightforward, however. In a Lancashire town where a new sodium lighting scheme has just been completed, among the problems that the lighting engineers had to contend with were road flooding to a depth of three feet; uncharted stone drains and culverts dating back to the fifteenth century; and loose ground, running sand and rock on a mountainside road.

* * *

From the report of Mr. B. Woodfull, city electrical engineer of Melbourne, I learn that considerable development of the use of off-peak thermal storage space heaters has taken place there, and "the public is now realizing the commercial possibilities of this method of heating." This is not surprising, for I see that the average price paid for electricity for this purpose last year was 0·825d per kWh compared with 4·71d in the case of supplies for conventional radiators. Nevertheless, consumption by the latter is still twice as much as by the thermal storage heaters.

* * *

According to the *South Wales Echo & Evening Express* tests have been carried out by German scientists to refute rumours that TV is dangerous to health due to X-rays emanating from the TV screen. The report concludes with the following:—

> "Even if an individual held a TV screen to his body for a week the result would be negligible and harmless, claimed the scientists."

Despite this assurance I shall continue to use my set in the orthodox manner.

* * *

The following letter in the Glasgow *Evening News* baffles me:—

> "In every large and small town many households have no electric power, and shun the expense of 'putting it in for a factor.' Running a battery wireless set is very costly. Cannot the Electricity Board pipe electric power for wireless sets only, charging an annual sum?"

* * *

The *Electrical Review* of 19th July, 1884, reports the following early example of the application of electricity to agriculture:—

> "At the Cork Agricultural Show last week Mr. Gerald Percival, who had charge of the electric lighting arrangements, gave a manifestation of the transmission of power by electricity, driving two churns and a worker by means of the current from a Gramme machine, conveyed through the whole length of the electric light cables, a distance of about 1,800ft, to a Jarman dynamo, which acted as a motor. The same agency was afterwards employed to work a chaff-cutter."

In case any reader wonders how the "worker" fared, I am told that this term refers to equipment used in butter-making.

Electric Power Transmission Calculations

The Per Unit System

By WILLIAM T. TAYLOR, M.I.C.E., M.I.E.E., F.A.I.E.E.

A previous article by the author on the same subject appeared in the "Electrical Review" of 6th February, 1953

SHORTER transmission lines than 100 miles are normally able to deliver a load greater than their natural load, whereas lines of 200 miles and longer normally deliver less than full natural load. This natural load, more commonly called surge-impedance load, is regarded as the critical load.

Every transmission line has its particular natural load, created by the electrical characteristics r, x, g and x_c of the line itself. This load is proportional to E^2/z_o, where z_o is the surge impedance of the line, independent of its length but dependent on the supply frequency. For the 50 c/s lines discussed throughout this series the surge impedance (based on the primary characteristics) is

$$z_o = \sqrt{z/y} = \sqrt{(0{\cdot}2921 + j0{\cdot}6354)/(0{\cdot}0000 + j4{\cdot}665 \times 10^{-6})}$$
$$= \sqrt{(0{\cdot}6993 \text{ at } 65{\cdot}32^\circ)}/(4{\cdot}665 \times 10^{-6} \text{ at } 90{\cdot}00^\circ)$$
$$= 387{\cdot}2 \text{ at } -12{\cdot}34^\circ$$

This natural condition remains unaltered for any length of line possessing the same electrical characteristics per unit length; see also z_o for the 200 mile line previously discussed.

In power transmission problems it is the ever-present properties of the line itself, not the variable properties of the load it carries, that claims the most interest and must be carefully determined—though both are incorporated in the complete electrical calculations, since one is made worthless without the other. The first step is the determination of the primary characteristics, then the ABC line constants. To do this it is necessary to assume a line voltage in order to get the necessary conductor clearances, also select a line conductor size on the basis of a given probable future load. Taken generally, the transmission problem centres around the ABC line and incorporated sending-end and receiving-end transformer constants; then the usual procedure is by way of the $A_oE_r + B_oI_r$ and $C_oE_r + D_oI_r$ quantities.

For reasons given below the procedure herein is by way of the power circle diagram calculations, commencing with P_b/B and leading to $P_m + jQ_m$ to determine the equivalent of E_s and the phase displacement angle between E_r and E_s. Ordinarily, the procedure is by way of the "step" method given in this series. Both methods should be used as a check for accuracy, which is an advantage not claimed by the commonly used method that provides a graph substitute but no alternative method that checks the accuracy at one or more steps of the calculations.

Constants A″ and B″ are fixed for a given length of line, and the only assumed quantity is a given receiving-end power which varies from time to time between maximum and minimum. An error in any A″ or B″ co-ordinate will produce a wrong answer, just as an error in any co-ordinate of the A and B and C constants (required for computing E_s and I_s) will produce a wrong answer, and the desirability of this check is self-evident. Any method of computing h.v. transmission problems that provides a sufficient number of checks for accuracy (even if they are more laborious) is commendable. Starting a problem as suggested here with circle diagram work is advantageous because it is a guiding check on the accuracy of the principal constants, also a check on the accuracy of the sending-end voltage and phase displacement angle between E_r and E_s.

Now consider the following transmission problem: A 130 mile 50 c/s 3-phase 132 kV overhead line consisting of three 0·15 sq in equivalent copper (steel-cored stranded aluminium) conductors spaced equilaterally 12·25 ft, offering the following per unit (1·0 mile) values,

$$r = 0{\cdot}2921 \text{ ohm.} \qquad x = 0{\cdot}6354 \text{ ohm.} \qquad g = 0{\cdot}000.$$
$$x_c = 4{\cdot}665 \times 10^{-6} \text{ mho.}$$

Base voltage is 132 kV and base power is 50·0 MVA; base impedance and base admittance are

$z_b = 132^2/50{\cdot}0 = 348{\cdot}48$ ohms and
$y_b = 1/348{\cdot}48 = 0{\cdot}000287$ mhos.

The equivalent *per unit* quantities are

$z = (0{\cdot}2921 + j0{\cdot}6354)/348{\cdot}48 = 0{\cdot}000838 + j0{\cdot}001823$ ohms per mile (in per unit).

$y = (0{\cdot}0000 + j4{\cdot}665 \times 10^{-6})/0{\cdot}000287 = 0{\cdot}0000 + j0{\cdot}001625$ mho/mile (in per unit).

And for 130 miles of line,

$Z = 130 \times (0{\cdot}000838 + j0{\cdot}001825) = 0{\cdot}1089 + j0{\cdot}23699$ in per unit.

$Y = 130 \times (0{\cdot}0000 + j0{\cdot}001625) = 0{\cdot}0000 + j0{\cdot}21125$ in per unit

so that

$YZ = (0{\cdot}0000 + j0{\cdot}21125)\,(0{\cdot}10894 + j0{\cdot}23699) = -0{\cdot}05006 + j0{\cdot}02301.$

Using infinite series expansions, now compute the ABCD constants:

Constant $A = 1 + 1/2(YZ) + 1/24(YZ)^2 + \ldots.$
where $1/2(YZ) = -0{\cdot}025032 + j0{\cdot}01150;$
$1/24(YZ)^2 = 0{\cdot}000082 - j0{\cdot}000098$
$A = (1{\cdot}0000 + j0{\cdot}0000) + (-0{\cdot}025032 + j0{\cdot}01150) + (0{\cdot}000082 - j0{\cdot}000098)$
$= 0{\cdot}97505 + j0{\cdot}01141 = a_o + ja_q$

Constant $B = Z[1 + 1/6(YZ) + 1/120(YZ)^2 + \ldots.]$
where $1/6(YZ) = -0{\cdot}008344 + j0{\cdot}003852;$
$1/120(YZ)^2 = 0{\cdot}00000 - j0{\cdot}00000$
$B = Z[(1{\cdot}0000 + j0{\cdot}0000) + (-0{\cdot}008344 + j0{\cdot}003852) + (0{\cdot}00000 - j0{\cdot}00000)]$
$= (0{\cdot}10894 + j0{\cdot}23699)\,(0{\cdot}99166 + j0{\cdot}003852) = 0{\cdot}10712 + j0{\cdot}23550 = b_o + jb_q$

Constant $C = Y[1 + 1/6(YZ) + 1/120(YZ)^2 + \ldots.]$
$= (0{\cdot}0000 + j0{\cdot}21125)\,(0{\cdot}99166 + j0{\cdot}003852) = -0{\cdot}0008136 + j0{\cdot}20948 = c_o + jc_q.$

Collecting these constants we get

$A = 0{\cdot}97505 + j0{\cdot}01141 = 0{\cdot}9765$ at 0·67 deg.
$B = 0{\cdot}10712 + j0{\cdot}23550 = 0{\cdot}2587$ at 65·53 deg.
$C = -0{\cdot}0008136 + j0{\cdot}20949 = 0{\cdot}20954$ at 90·20 deg.
$D = 0{\cdot}97505 + j0{\cdot}01141 = 0{\cdot}9765$ at 0·67 deg.

ELECTRICAL ANALYSIS OF FOUR 132 kV 3-PHASE 50 C/S 40·0 MVA TRANSMISSION LINES 200–150–100–50 MILES IN LENGTH—BY THE PER UNIT SYSTEM

1	Electrical properties of the line, per mile length	r = 0·2921 ohm; x = 0·6354 ohm; g = 0·000; $x_c = 4·665 \times 10^{-6}$ mho			1
2	Electrical properties of the line independent of length	z_o = 387·2 ohms (surge impedance); Pz_o = 45 MVA (surge-impedance loading)*			2
3	Primary base voltage and power quantities	E_b = 132 kV (line-to-line) base voltage; P_b = 50 MVA (3-phase) base power			3
4	Secondary base impedance and admittance quantities	$z_b = 132^2/50 = 348·48$ ohms impedance; $y_b = 1/348·48 = 0·000287$ mhos admittance			4
5	$z = (r + jx)/z_b$ per unit ohm/mile; $y = (g + jx_c)/y_b$ per unit mhos/mile	0·000838 + j0·001823 at 65·30 deg; 0·0000 + j0·0001625 at 90·00 deg			5
6	Transmission line length in miles	200	150	100	50	6
7	$Z = s(r + jx)/z_b$ total (ohms) in per unit	0·1676+j0·3646	0·1257+j0·27345	0·0838+j0·1823	0·04190+j0·09115	7
8	$Y = s(g + jx_c)/y_b$ total (mhos) in per unit	0·0000+j0·3250	0·0000+j0·24370	0·0000+j0·1625	0·00000+j0·08125	8
	Line ABCD constants:					
9	$A = 1 + 1/2(YZ) + 1/24(YZ)^2 + \ldots$	0·9412 +j0·0267	0·9669+j0·01515	0·9852+j0·0068	0·9963+j0·0017	9
10	absolute value and angle	0·9415 at 1·62 deg	0·9670 at 0·90 deg	0·9852 at 0·40 deg	0·9963 at 0·10 deg	10
11	$B = Z[1 + 1/6(YZ) + 1/120(YZ)^2 + \ldots]$	0·1610+j0·3590	0·1229+j0·2710	0·0833+j0·1818	0·4184+j0·091046	11
12	absolute value and angle	0·3935 at 65·84 deg	0·2803 at 65·60 deg	0·2002 at 65·38 deg	0·1002 at 65·23 deg	12
13	$C = Y[1 + 1/6(YZ) + 1/120(YZ)^2 + \ldots]$	−0·002+j0·3180	−0·00124+j0·2414	−0·000037+j0·1617	−0·000046+j0·08115	13
14	$D = A$	0·9412+j0·0267	0·9669+j0·01515	0·9852+j0·0068	0·9963+j0·0017	14
15	*Check* for accuracy, $A^2 - BC = 1·0$	0·999+j0·000	1·000+j0·000	1·000+j0·000	0·999+j0·000	15
			(Constant C not required in circle diagram work)			
16	Constant receiving-end voltage, in per unit	1·000+j0·000 in per unit				16
17	Assumed receiving-end power, P_r(MVA)	40·0 megawatts at unity power factor				17
18	$P_r(pu) = P_r/P_b[1 + \tan(\cos^{-1}1·00)]$ in per unit	0·800+j0·000 in per unit				18
19	Receiving-end current, $I_r(pu) = P_r(pu)/E_r(pu)$	0·800−j0·000 in per unit				19
	Solution by the usual procedure:					
20	Required sending-end voltage, $E_s = AE_r + BI_r$ in per unit	1·070+j0·3139	1·065+j0·23195	1·0518+j0·1522	1·0297+j0·07454	20
21	Scalar value and phase angle	1·115 at 16·35 deg	1·0901 at 12·28 deg	1·0626 at 8·23 deg	1·032 at 4·13 deg	21
22	Actual required sending-end voltage	147·2 kV	144·0 kV	140·3 kV	136·2 kV	22
23	Voltage loss when delivering 40 MVA is $E_s - E_r$	15·2 kV	12·0 kV	8·3 kV	4·2 kV	23
24	Required sending-end current, $I_s = CE_r + DI_r$ in per unit	0·751+j0·339	0·7723+j0·2535	0·7881+j0·1671	0·7970+j0·08251	24
25	Phase angle, $\varnothing I_s$	at 24·30 deg	at 18·15 deg	at 11·98 deg	at 5·90 deg	25
26	Angle between sending-end voltage and current, $\varnothing_s = \varnothing I_s - \varnothing E_s$	7·95 deg	5·87 deg	3·75 deg	1·77 deg	26
27	Sending-end power factor, cos $\varnothing_s$, per cent	99·04 leading	99·4 leading	99·8 leading	99·98 leading	27
28	Required sending-end power, $P_s = E_sI_s$ (complex) in per unit	0·91597−j0·127	0·8813−j0·0909	0·85389−j0·0558	0·8268−j0·0255	28
29	Actual sending-end power in MVA	45·8−j6·35	44·0−j4·54	42·7−j2·79	41·34−j1·28	29
30	Phase angle, $\varnothing P_s$; *check* on sending-end power factor	7·95 deg	5·87 deg	3·74 deg	1·77 deg	30
31	Power loss, $P_L = P_s - P_r$ (MW)	5·8	4·0	2·7	1·34	31
	Solution by circle diagram:					
32	Constant B scalar value carried forward to convert to 1·000	0·3935	0·2976	0·2000	0·1002	32
33	$B' = P_b/B$ (new MVA base)	127·06	168·0	250·0	499·0	33
34	B'/P_b	2·5412	2·360	5·00	9·98	34
35	$B'' = (b_o + jb_q)(B'/P_b) = B_o + jB_q$	0·40913+j0·9123	0·4129+j0·9106	0·4165+j0·9090	0·4176+j0·9086	35
36	Scalar value of $B_o + jB_q$	0·9998	0·9999	0·9999	0·9999	36
37	*Check*, $\varnothing B'' = \tan^{-1}(B_q/B_o)$	at 65·84 deg	at 65·60 deg	at 65·38 deg	at 65·32 deg	37
38	$A'' = (a_o - ja_q)(B_o + jB_q) = A_o + jA_q$	0·4094+j0·8477	0·41303+j0·8742	0·4165+j0·8927	0·4176+j0·9045	38
39	Phase angle $\varnothing A'' = \tan^{-1}(A_q/A_o)$	at 64·22 deg	at 64·70 deg	at 64·99 deg	at 65·23 deg	39
40	$P'_r = E_rA_o$	0·4094	0·41303	0·4165	0·4176	40
41	$Q'_r = E_rA_q$	0·8477	0·8742	0·8927	0·9045	41
42	$P'_r + jQ'_r$	0·9931	0·9669	0·9851	0·9962	42
43	*Check*, $\varnothing A'' = \tan^{-1}(Q'_r/P'_r)$	at 64·22 deg	at 64·70 deg	at 64·99 deg	at 65·23 deg	43
44	Receiving-end power per unit quantity, $P_r(pu) = P_r/B'$	0·31496	0·23809	0·1600	0·0801	44
45	Circle radius, $C_r = E_rE_s$ in per unit	1·1150	1·0901	1·0626	1·032	45
46	$P'_s = E^2_sA_o$ in per unit	0·5090	0·4808	0·4702	0·4447	46
47	$B''_p = (P'_s + P'_r)/2B_o$ in per unit	1·122	1·0823	1·0644	1·0324	47
48	Power loss line, $P_{Lb} = B'^2B_o$	103·94	138·33	208·25	416·75	48
49	Now measure the plotted power loss, P_L(pu)	0·056	0·029	0·013	0·003	49
50	*Check* diagram measurement with converted P_L (MW)	5·82	4·0	2·707	1·26	50
	For the equivalent vector E_s and angle $\varnothing E_s$, *check* with the following:					
51	$(P'_r + P_r) + j(Q'_r + Q_r) = P_m + jQ_m$	1·115	1·0901	1·0626	1·032	51
52	$\varnothing_m = \tan^{-1}(Q_m/P_m)$	at 49·49 deg	at 53·32 deg	at 57·15 deg	at 61·19 deg	52
53	*Check* phase-angle $\varnothing E_s$ with $\varnothing B'' - \varnothing_m = \varnothing_v$	at 16·35 deg	at 12·28 deg	at 8·23 deg	at 4·13 deg	53

* Properties of the line are distinct from properties of the load, and when designing on the basis of *natural* load we are principally concerned with the properties of the line. To find the natural load we may assume either E_r or E_s, then compute the electrical characteristics of the line. This load is an impedance equivalent of the surge impedance. When the impedance *of the load* has a higher value than the surge impedance *of the line*, the load is less than the *natural* load.

Evidently, expansion $1/120(YZ)^2$ can be omitted, and expansion $1/24(YZ)^2$ is on the border line; hence the expansions for 100 mile and shorter lines* need be

$A = 1 + 1/2(YZ) + \ldots.$
$B = Z\,[1 + 1/6(YZ) + \ldots.]$
$C = Y\,[1 + 1/6(YZ) + \ldots.]$

Checking B and C constants against the surge impedance, they should (if correct) equal

$$\sqrt{B/C} = \sqrt{(0{\cdot}10712 + j0{\cdot}2355)/(-\ 0{\cdot}0008136 + j0{\cdot}209498)}$$
$$= \sqrt{(0{\cdot}2587 \text{ at } 65{\cdot}53^\circ)/(0{\cdot}20954 \text{ at } 90{\cdot}20^\circ)} = \sqrt{1{\cdot}2346 \text{ at } -24{\cdot}78/2}$$
$$= 1{\cdot}1111 \text{ at } -12{\cdot}34 \text{ deg.}$$

And converting to ohms,

$Z_o = 1{\cdot}1111 \times 348{\cdot}48 = 387{\cdot}2$ at $-12{\cdot}34$ deg (which check exactly).

Checking all the constants by means of the expression $A^2 - BC$, to see how close they are to $1{\cdot}0000 + j0{\cdot}0000$, we get

$$(0{\cdot}97505 + j0{\cdot}01141)^2 - (0{\cdot}10712 + j0{\cdot}2355)(-\ 0{\cdot}0008136 + j0{\cdot}209498)$$
$$= 1{\cdot}0000 + j0{\cdot}0000.$$

When the ABCD constants are found the usual approach to the final solution is by way of the E_s and I_s calculations. In this 130 mile problem the final solution is approached by way of the A″ and B″ constants. Knowing A″ and B″ and the receiving-end voltage and power we can compute the circle diagram and solve the problem simultaneously.

(1) *Solution by way of constants A″ and B″:*

$P_b/B = 50{\cdot}0/0{\cdot}2587 = 193{\cdot}3$ MVA new base; hence, $193{\cdot}3/50 = 3{\cdot}866$

$B'' = (0{\cdot}10712 + j0{\cdot}2355) \times 3{\cdot}866 = 0{\cdot}4141 + j0{\cdot}9104 = 1{\cdot}0001$ at 65·53 deg $= B_o + jB_q$

$A'' = (0{\cdot}97505 - j0{\cdot}01141)(0{\cdot}4141 + j0{\cdot}9104) = 0{\cdot}41415 + j0{\cdot}88296$ at 64·87 deg $= A_o + jA_q$

Receiving-end per unit power, $P_r(pu) = 40{\cdot}0/193{\cdot}3 = 0{\cdot}2070$

Receiving-end per unit voltage, $E_r(pu) = 1{\cdot}000 + j0{\cdot}000$

$P'_r = E_r^2 A_o = 0{\cdot}4141$ and $Q'_r = E_r^2 A_q = 0{\cdot}8829$

$P'_r + jQ'_r = 0{\cdot}4141 + j0{\cdot}8829 = 0{\cdot}9751$ at $64{\cdot}87^\circ$

$P_m - jQ_m = (P'_r + P_r) + j(Q'_r + Q_r) = (0{\cdot}4141 + 0{\cdot}2070) + j(0{\cdot}8829 + 0{\cdot}000)$
$= 0{\cdot}6211 + j0{\cdot}9929 = 1{\cdot}0795$ in per unit

$\phi_m = \tan^{-1}(0{\cdot}9929/0{\cdot}6211) = \tan 1{\cdot}4235 = 54{\cdot}88^\circ$

$\phi_v = \phi_{B''} - \phi_m = 65{\cdot}53^\circ - 54{\cdot}88^\circ = 10{\cdot}65^\circ$

$C_r = E_r E_s = (1{\cdot}000 + j0{\cdot}000)(0{\cdot}6211 + j0{\cdot}8829) = 1{\cdot}0795$ in per unit

The scalar value of $P_m + jQ_m$ is the equivalent of the required sending-end voltage, so that the difference between E_r and E_s is $1{\cdot}0795 - 1{\cdot}0000 = 0{\cdot}0795$ in per unit; hence, the actual voltage loss (drop) is $0{\cdot}0795 \times 132 = 10{\cdot}5$ kV $= 8{\cdot}0$ per cent

$P'_s = E^2 A_o = 1{\cdot}0795^2 \times 0{\cdot}4141 = 1{\cdot}1653 \times 0{\cdot}4141 = 0{\cdot}48255$ in per unit

$B''_q = (P'_s + P'_r)/2B_o = (0{\cdot}48255 + 0{\cdot}4141)/2 \times 0{\cdot}4141 = 1{\cdot}082$ in per unit

$P_{Lb} = P'_b(2B_o) = 193{\cdot}1 \times 2 \times 0{\cdot}4141 = 160{\cdot}09$ MW

The measured power loss is 0·0219 in per unit or $160{\cdot}09 \times 0{\cdot}0219 = 3{\cdot}5$ MW.

The sending-end active (real) power is $(160{\cdot}09 \times 0{\cdot}0219) + 40{\cdot}0 = 3{\cdot}5 + 40 = 43{\cdot}5$ MW.

The power circle diagram serves as a reliable check since the computed quantities, angles and dimensions must all fit into place exactly for accuracy. This check is desirable at all times.

(2) *Solution by way of E_s and I_s:*

As this problem is for the line alone, there is but one voltage and current level above that of E_r and I_r. In

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* For 132 kV and higher voltage lines ranging between about 125–220 miles, *add*
2nd Expansion: $(YZ)^2 = (a^2 - b^2) + j2ab = a_1 - jb_1$.
For 132 kV and higher voltage lines ranging between about 225–320 miles, *add*
3rd Expansion: $(YZ)^3 = (a^2 - 3ab^2) + j(2a^2 - b^3)$
or $(YZ)(YZ)^2 = (a_1 - jb_1)(-a + jb) = (-aa_1 + jab_1) + j(bb_1 + jba_1)$.
For lines above 320 miles in length, *add*
4th Expansion: $(YZ)^4 = a^4 - ba^2 - b^2 + b^4 + 4j(ab^3 + ba^3)$
or $(Y^2Z^2)^2 = (a_1^2 - b_1^2) + j^2 a_1 b_1$.

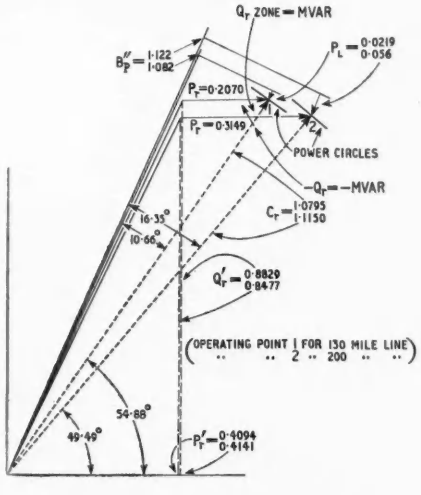

Fig. 1

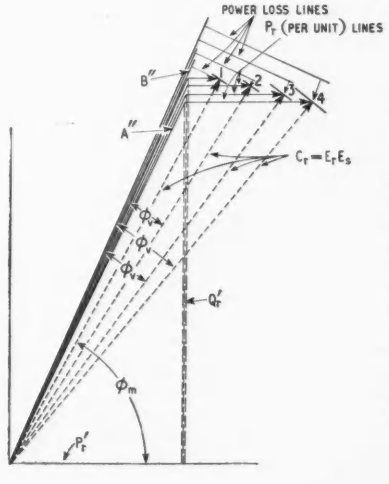

Fig. 2

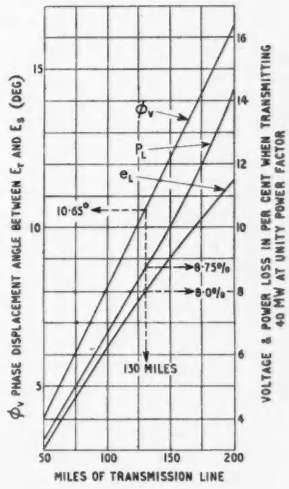

Fig. 3

Fig. 1.—Performance of a 130 mile and a 200 mile 3-phase 132 kV transmission line, each transmitting 40·0 MW at unity power factor. Fig. 2.—Performances of four 3-phase 132 kV transmission lines of widely different lengths (50, 100, 150 and 200 miles), each transmitting 40·0 MW at unity power factor. Fig. 3.—Percentage voltage and power losses and phase-displacement angles between E_r and E_s of 3-phase 132 kV transmission lines (50 up to 200 miles) when transmitting 40·0 MW at unity power factor

solution (1) only one set of constants are involved, and of these only the A and B constants given above need be computed.

Commencing with the line-to-line sending-end voltage calculation on the assumption that the receiving-end *per unit* voltage $E_r = 1{\cdot}000 + j0{\cdot}000$, and the active (real) receiving-end power is 40·0 MW at unity power factor; then,

$$P_r = 40/50\,[(1 + j\tan)(\cos^{-1}1{\cdot}0)] = 45/50\,(1 + j1{\cdot}0) = 0{\cdot}800 + j0{\cdot}000$$

$$I_r = P_r/E_r = (0{\cdot}800 + j0{\cdot}000)/(1{\cdot}000 + j0{\cdot}000) = 0{\cdot}800 - j0{\cdot}000 \text{ in per unit}$$

Sending-end voltage, $E_s = AE_r + BI_r$

$$= (0{\cdot}97505 + j0{\cdot}01141)(1{\cdot}000 + j0{\cdot}000) + (0{\cdot}10712 + j0{\cdot}2355)(0{\cdot}800 - j0{\cdot}000)$$

$$= 1{\cdot}06107 + j0{\cdot}2000 = 1{\cdot}0794 \text{ at } 10{\cdot}66 \text{ deg}$$

or $1{\cdot}0794 \times 132 = 142{\cdot}5$ kV at 16·66 deg.

This E_s scalar value checks with $P_m + jQ_m$ scalar value.

Sending-end current, $I_s = CE_r + DI_r$

$$= (-0{\cdot}0008136 + j0{\cdot}20949)(1{\cdot}000 + j0{\cdot}000) + (0{\cdot}97505 + j0{\cdot}01141)(0{\cdot}800 - j0{\cdot}000)$$

$$= 0{\cdot}7792 - j0{\cdot}2186 \text{ at } 15{\cdot}66 \text{ deg.}$$

Sending-end power, $P_s = E_sI_s$ (complex form)

$$= (1{\cdot}06107 + j0{\cdot}01141)(0{\cdot}7792 - j0{\cdot}2186) = 0{\cdot}8702 - j0{\cdot}0762 \text{ at } 5{\cdot}00 \text{ deg.}$$

Sending-end power factor, $\cos\phi_s = \phi I_s - \phi E_s = 15{\cdot}66$ deg $- 10{\cdot}66$ deg $= 5{\cdot}00$ deg $=$ cos 99·6 per cent (lead).

Actual sending-end power, $P_bP_s = 50 \times (0{\cdot}8702 - j0{\cdot}0762) = 43{\cdot}5 - j3{\cdot}8 = 43{\cdot}67$ MVA

(Negative sign $-$ Q_s indicates a quantity below the surge-impedance loading.)

Active power loss, $P_L = 43{\cdot}5 - 40{\cdot}0 = 3{\cdot}5$ MW.

Per unit power loss is $3{\cdot}5/160{\cdot}09 = 0{\cdot}0219$. This P_L per unit power loss quantity checks with Fig. 1 power-loss measurement; the diagram also includes the 200 mile line which is based on the same receiving-end voltage and power.

The above analysis presents a simple illustration for the line alone involving the electrical properties, the circuit constants, the final E_s and I_s calculations, and the performance power circle diagram.

A transmission system may not consist of the same conductor size throughout, and with time it may extend to other receiving stations. As a general rule, ordinary MVA capacity radial lines are single circuit with conductors of the same size throughout, while main h.v. lines may consist of two or more circuits operating in parallel. For each case a record should be kept of the physical and electrical properties so that calculations may be made for any desired or particular operating condition. The electrical properties of the line, transformers, etc., must be known before the general circuit constants can be computed. For lines, machinery, and apparatus that operate in parallel the electrical properties may become involved as several operating combinations are made possible. The final E_s and I_s calculations and those for the circle diagram must be made irrespective of the particular single or parallel-circuit problem which may be for the line alone, for line and transformers, or for line, transformers, and generators.

Throughout these calculations, 3-phase voltage and power are used, thus avoiding extra figures and labour involved in changing to phase-to-neutral and back to 3-phase. And it will be seen that scalar values are reduced to those required only for constant B and the sending-end voltage E_s and its equivalent.

Based on a fixed transmission length of 200 miles, solutions were previously given for lines operating at either constant or variable sending-end voltage and constant receiving-end voltage with constant (and variable) receiving-end power. Herein are four transmission line problems for lines of different length varying in four steps of 50 miles each. These four radial-type transmission lines are assumed to have the same electrical characteristics; namely, conductors of the same material and of the same size and same line arrangement, and the calculations for each line are based on the same receiving-end voltage and power.

The four problems shown in Fig. 2 represent graphically the results of the analysis given in the Table which show that the sending-end voltage, active sending-end power, power loss, and phase displacement angle between E_r and E_s, all increase with increase in line length. It is shown that the sending-end voltage is increased from 136·2 kV to 147·2 kV, the voltage loss is increased from 4·2 kV to 15·2 kV, the power loss is increased from 1·34 MW to 5·8 MW, and the phase displacement angle is increased from 4·13 to 16·35 deg. Fig. 2 shows the operating points marked 1, 2, 3 and 4; mark 1 is for the 50 mile line and mark 4 is for the 200 mile line. These four performances are plotted in one diagram to facilitate selection of the most appropriate sending-end voltage. These and the previously mentioned transmission problems are for steady-state power flow only.

The analysis of the four problems reveals that the *ordinary* co-ordinates of A and B constants decrease with increase in line length, whereas the *quadrature* co-ordinates increase with increase in line length. The *ordinary* co-ordinates of A″ and B″ constants remain practically constant, increasing slightly with increase in line length. The *quadrature* co-ordinate of A″ decreases slightly with increase in line length while that of co-ordinate B″ increases slightly with increase in line length.

On the basis of equal per unit electrical properties of the line also equal receiving-end voltage and power as well as equal sending-end voltage, a higher voltage can be expected at the end of the 50 mile than at the end of the 200 mile line, provided no corrective measure is applied. For each of the four separate lines a voltage of 132 kV gives a 3-phase surge-impedance loading of 45·0 MVA, but increasing the voltage by 5 per cent increases the surge-impedance loading to 49·4 MVA; in other words, this *natural* loading increases as the square of the voltage.

The percentage voltage and power losses and the degree phase displacement angles between the sending-end and the receiving-end voltages are given in Fig. 3 for 132 kV transmission lines ranging in length from 50 miles up to 200 miles, transmitting 40 MW at unity power factor. Values for the 130 mile transmission problem are marked.

By increasing the leading reactive-power output of synchronous condensers (assuming they possess ample MVA capacity) it is possible to get a rising voltage with an increase of load. Also, by increasing the ratio of transformation by taps it is possible to reduce the synchronous condenser output; and conversely, by reducing the ratio of transformation it is possible to increase the required output of synchronous condensers. To embody a surplus of leading reactive-power in the generators is commendable. The initial cost of adding 1·0 MVA to the leading p.f. output of a generator is approximately one-half the initial cost of adding the same MVA to the lagging p.f. rating.

The initial cost of a reactive-power corrective should come second to improved service and better stability from ample synchronous condenser capacity. Generators may be used to supply the difference between the line lagging (inductive) reactive-power and part of the line leading (capacitive) reactive-power, and, synchronous condensers

may be used to supply the difference between the load requirements for leading reactive-power and part of the line (capacitive) reactive-power; the actual leading/lagging reactive-power requirements will vary somewhat for each case, depending on the particular system and conditions presented. For transmission systems of this magnitude, a margin of reactive-power that is used up for steady-state operation is not sufficient. To tide over fault and power emergency conditions (such as the temporary loss of a line or transformer or generator), surplus reactive-power is necessary.

As yet there is no generally accepted designation for maximum load capability or "full" load, which can be interpreted to mean a load capability somewhere between the most favourable and least favourable system conditions and operating possibilities. Maximum load capability is dependent upon available reactive-power at the supply-end and all big load centres. A surplus of reactive-power is usually more necessary than a surplus of active-power and, unlike the latter, reactive-power cannot be supplied effectively from remote sources; moreover, surplus reactive-power is often the only safety factor and margin available for the operating engineers to maintain stability and give service in times of emergency.

Each load centre should preferably supply and control its own reactive needs, and this applies to generators at the sending end which should possess a surplus MVAR capability above that used up in normal operation—failing which, the generator load should be reduced to some percentage below full MVAR capability in order to possess a surplus for emergencies. Neither excitation nor ratio of transformation or fixed taps should be allowed to limit the use of full MVAR capability of station generators. As reactive-power losses in transmission can be many times that of line losses, both losses should be recorded.

Any synchronous machine can produce reactive-power in the over-excited state and consume it in the under-excited state; hence the terms: leading and lagging reactive-power. In the power circle diagrams given herein the lagging reactive-power zone is above the unity power-factor or active-power P_r axis, and the leading reactive-power zone is below it (see Fig. 1). Active-power is the *ordinary* or real component P_r = MW, and reactive is the *quadrature* or imaginary component $\pm Q_r$ = MVAR or $-$ MVAR. The writer suggests that active-power P_r be spoken of as the watt, kilowatt or megawatt (abbreviated W, kW or MW), and reactive spoken of as the var, kilovar or megavar (abbreviated VAR, kVAR or MVAR); the positive direction of the latter is MVAR and the negative is $-$ MVAR. Our primary concern is with the system condition $\pm$ *var* requiring correction; our secondary concern is the introduced corrective called over-under excitation which is also $\pm$ *var*.

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LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Domestic Heating

REFERRING to the article on domestic heating by Mr. A. C. Hazel, in your 11th June issue, the author is behind the times about a special tariff, as this has already been offered by the majority of the Electricity Boards. It is usually below 1d per unit and is available at least between the hours of 10 p.m. and 7 a.m., and in some cases for a longer period.

Unfortunately the fluid filled electric central heating safety radiators do not store sufficient energy, so that they cannot be used during the above-mentioned hours and retain their heat for the following day to keep the premises warm. It requires a special block type of radiator, insulated with fibreglass, and this equipment, when energized between off-peak hours, will definitely heat the premises for the period following 7 a.m. onwards, until 10 p.m.

Such equipment would help to provide the ideal load factor for the supply authorities, and many are already trying it out, but unfortunately at the moment the tariff is only in its early stages and, except in the London Electricity Board area, there has not been much effect on the load factor. Many thousands of kilowatts would, of course, have to be installed to alter the shape of the curve, which for so many years has had a nasty dip during the night.

In consequence of freedom from purchase tax, however, these radiators are not available for domestic use. It is one of those cases in which the Board of Trade could help the development of the electricity supply industry and also help to lower costs by considering making this type of radiator available for the domestic market.

It is up to the general public to protest at this discrimination, once again, against the domestic user by the Board of Trade in restricting the supply of thermal storage heating appliances. With a shortage of coal in prospect for next winter, and the free availability of ordinary space heating appliances for use during peak hours, further embarrassment will be caused to the Electricity Boards, whereas if additional space heating load could be taken on the thermal storage system, there would be very much less trouble.

Birmingham, 1. A. J. MARE.

I WOULD like to comment further on Mr. Hazel's letter in the 2nd July issue, and to augment the information I have already given. I referred to winter quarters in my letter, but as Mr. Hazel has given some interesting comparative figures on a yearly basis, I have looked out my total accounts for the year. These amount to £62 17s 6d for electricity consumed and the standing charge.

Now if one assumes thirty winter weeks—in this country the winter usually lasts longer than this—Mr. Hazel's charges would be £30 for electricity for the winter. I am

told that "Coalite" costs £8 13s 6d per ton, so Mr. Hazel's 1½ cwts a week would cost £34 per annum. Therefore Mr. Hazel's annual cost without his electricity cost for the summer months is almost exactly the same as my figure for the year. I do submit that Mr. Hazel's conclusion that a combination of electricity and solid fuel is cheaper—when he is quoting his own case—is untrue.

This comparison is, of course, on a fuel to fuel basis, and I did not actually make this claim. I said that when all the relevant factors are taken into consideration electricity is cheaper, but taking Mr. Hazel's own figures it appears that in this particular instance electricity is cheaper even on a fuel to fuel basis.

In describing my own cottage I mentioned that I had installed ceiling panels, but it must not be thought that the economy is solely due to this application of electrical heating. I have, as a matter of interest, built another small house of about the same area as my own, but where the standard of decoration did not warrant the installation of panel heating, and we installed 4 kW of Hurseal radiators and 6½ kW of Ferranti electric fires, the hot water again being supplied from a "Sadia" heater. The annual electricity costs for this house are about £5 lower than my own which is consistent with the rather smaller heat loss.

G. H. BUCKLE, M.CONS.E., M.I.Mech.E., M.I.H.V.E., Associate I.E.E.

London, S.W.7. G. H. Buckle & Partners.

Earthing Methods

REVERTING to the article "Farm Installations" which appeared in the 9th July issue of the *Electrical Review*, while I am reluctant to argue earthing problems with such an eminent authority on the subject as the author, Mr. T. C. Gilbert, I would suggest, with respect, that certain of his contentions are based more on theory than practical problems in the field. I refer to Mr. Gilbert's insistence, for many years, that the existence of parallel earth paths is rarely a real problem "but can very often be overcome with attention to the alternative paths." If he had said "can on a few infrequent occasions be overcome by attention to the alternative path" I think it would have been more correct. In theory every case could be dealt with by attention to the fortuitous earth paths but the question of cost of this attention means that in most cases the theoretical certainty becomes a practical impossibility.

How, for example, does Mr. Gilbert suggest earth leakage trips can be employed for the protection of immersion heater installations at a reasonable cost? As he knows, from the case quoted in his article, it is frequently necessary to place the trip electrode 75 yards or so away. I know of cases where this distance has been considerably exceeded but it is not practicable when the farmyard is covered with 6in of concrete, or, in the case of a private dwelling, the garden is only 20ft long. To "insulate" the water system from the water main by inserting a length of plastic piping in the cold feed does not answer the problem, for many other fortuitous paths exist by way of waste pipes, etc.

Mr. Gilbert's assertion that it makes no odds where the leakage current goes so long as the potential on the protected casing is maintained below a dangerous level would, it appears, confirm that earth leakage trips afford no protection at all against fires caused by leakage currents.

I am surprised at his comments regarding the value of test buttons on differential current type trips—surely even with a standard earth leakage trip the test button only checks the mechanism and the earth electrode and will indicate "all well" even if the earth connection to the apparatus has come adrift.

I regret this entirely non-constructive criticism but it does seem to me that Mr. Gilbert's continued insistence that the standard earth leakage trips will answer pretty well all problems may be one reason why no manufacturer to my knowledge, has yet gone into the mass production of a differential current operated trip. If some manufacturer would take the plunge and put such a trip on the market at a reasonable cost I rather feel that the demand would very quickly enable costs to be cut still further and certainly, in many cases, to a figure below the cost of a standard trip plus the "attention" to fortuitous earths.

Prestatyn, Flints. J. A. WINCHESTER.

Qualifications

ARE they necessary? Yes, to a point, but the country has just gone mad on degrees. For nearly every post advertised the applicant must have the H.N.C. or an equivalent. Practical training appears to be no longer called for, because those who are getting responsible posts are young men of 20 to 24 years of age, who have spent their time at technical colleges and in the Forces, and thus have had no time for practical experience. They are put in charge of large areas and gangs of linesmen and jointers. It seems that in the Electricity Boards if you have no degree you are a back number.

I have served an articled apprenticeship and have had 20 years in responsible positions with experience on systems up to 33 kV, but I am now on a job of little importance and taking orders from the "young brigade." I just call it bad diplomacy. "DISILLUSIONED."

Women Electrical Engineers

THE paragraph in the 9th July issue of the *Electrical Review* recording Miss G. L. Entwisle's pioneer election as an associate member of the I.E.E. is linked, strangely enough, with your leader on circuit-breaking during the past fifty years.

At the end of last and the beginning of this century, there was a pioneer electrical engineer whose researches on the electric arc are regarded as a classic introduction to circuit-breaking, namely, the late Mrs. Hertha Ayrton (wife of Prof. W. E. Ayrton), whose distinction was recognized by her election as the first woman M.I.E.E. on 25th May, 1899. J.S.

BOOKS RECEIVED

The Physics of Experimental Method. By H. J. J. Braddock. Pp. 404; figs. and index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 35s.

Electronics. By A. T. Starr. Pp. 395; figs. and index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 32s 6d.

Introduction to Electric Fields. By Walter E. Rogers. Pp. 333; figs. and index. McGraw-Hill Publishing Co., Ltd., McGraw-Hill House, 95, Farringdon Street, London, E.C.4. Price 60s.

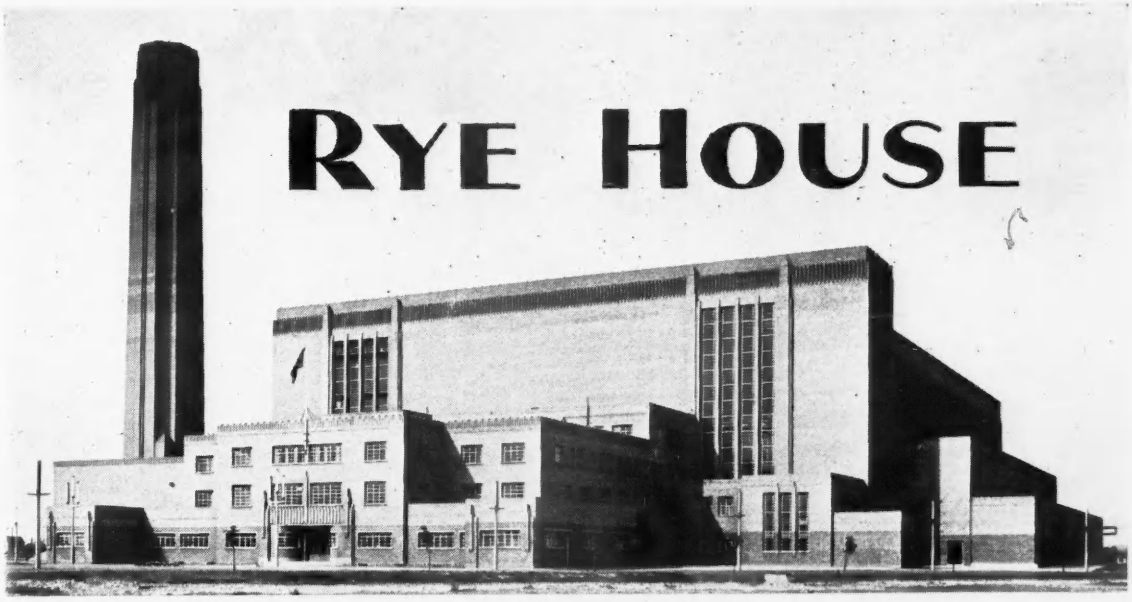
Mathematics in Action. By O. G. Sutton. Pp. 226; figs. 52; index. G. Bell & Sons, Ltd., 6, Portugal Street, London, W.C.2. Price 16s.

Questions and Answers on Power Station Practice and Plant. By T. H. Carr. Pp. 128; figs. and index. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 6s.

Questions and Answers on Distribution and Use of Electric Power. By T. H. Carr. Pp. 112; figs. and index. George Newnes, Ltd.

Clock Cleaning and Repairing. Edited by Bernard E. Jones. Pp. 176; figs. 94; index. Cassell & Co., Ltd., 37, St. Andrew's Hill, London, E.C.4. Price 4s 6d.

RYE HOUSE



Official Opening of 192 MW Pulverized Fuel Station

YESTERDAY, Thursday, Rye House generating station near Hoddesdon, Hertfordshire, was officially opened by the Hon. David Bowes-Lyon, Lord Lieutenant of Hertfordshire. Originally planned by the Northmet Power Co., construction of the station was deferred during the war and it was not until 1947 that work on site could be initiated. The station layout has been planned for an ultimate capacity of 192 MW, i.e. six 32 MW turbo-alternator sets. So far four machines have been installed.

The general layout of the station is such that the turbo-alternator sets are arranged transversely in the turbine room, with the coal bunkers and mechanical annexe interposed between the boiler house and the engine room. The precipitators are external to the station, being situated outside the boiler house. The induced draught fans, while also being outdoors, are partially protected by virtue of their position at ground level between the precipitators and the main gas flue leading to the chimney. The four boilers so far installed all pass their exit gases via the electrostatic precipitators to a single 260ft high chimney at the south-west corner of the main building. The station operates on the unit principle, there being one boiler to each machine.

Fuel for the plant is brought by rail from the East Midlands coalfields and delivered to the station reception sidings. The works locomotives feed and clear the wagons to wagon tippler sidings made by the Mitchell Engineering Co., Ltd., where the trucks are winched to the final tipping position. Two side discharge, weighing type, wagon tipplers are provided in a separate building, both machines being fitted with Sturtevant dust removal plant.

Underground conveyors feed the coal either to the station bunkers or the coal store. Storage and reclamation is by means of a drag scraper plant of the "Beaumont" type supplied by International Combustion, Ltd. The capacity of the machine is 200 tons/hr with an average haul of 220ft. The conveyors at the station end feed the boot of a gravity bucket elevator which raises the coal to the bunker conveyors where a travelling tripper facilitates the stocking of the various bunkers.

The four installed boilers are of the Babcock & Wilcox series high-head type and each has a maximum continuous evaporation rate of 350,000 lb/hr with superheater outlet steam conditions of 875 deg F and 650 lb/sq in. The boiler combustion chambers are fitted with Bailey water-cooled walls and are pulverized fuel fired. The superheater is of the single pass type, while the economizer, which is of the integral steaming type, is arranged in two sections, back to back, inside the boiler casing, with water in counter flow to the gases.

The boilers are fitted with single nozzle retractable type soot blowers and all the units, including fixed jet blowers on the air heaters, can either be operated automatically on sequence control or manually. The control equipment for automatic sequence operation is on a separate panel for each boiler and is mounted at operating floor level. Any blower head can be operated individually as required, and also any head can be taken out of service without upsetting the automatic operation of the remainder of the cycle.

The air pre-heaters are of the Howden-Ljungstrom regenerative type, there being two such units per boiler each having a heating surface of 55,900 sq ft. The forced draught fans are of James Howden & Co., Ltd., manufacture and are of the single inlet turbovane type, there being two units per boiler. Each fan has vane control equipment and is directly coupled to a two speed motor. The induced draught fans are of the same make and are of the double inlet design, there being two units per boiler. The vanes of both the forced draught and induced draught fans are controlled from the boiler control panel through a Lockheed hydraulic system. The boiler is fed with pulverized fuel from four B. & W. No. 44 "E" type mills. The primary air fans are of the single inlet centrifugal type, the impellers being of the backward curved blade design constructed in high tensile steel. The feed pumps are manufactured by G. & J. Weir & Co., Ltd., and are of the ten stage horizontal, centrifugal type each capable of normal load output of 193,000 lb/hr against a normal discharge pressure of 940 lb/sq in. There are three such pumps, all electrically driven, per set and for the first two boiler units a steam driven stand-by pump is also provided.

The ash handling system is of the hydrojet type designed for side discharge into the sluiceway, which can deal with ash at the rate of 40 tons per hour with a total water quantity of about 1,700 gal/min. The high pressure sluicing pumps are of the single stage centrifugal type each capable of passing 1,700 gal/min against a discharge head of 275ft. The ash is discharged from the sluiceway via a crusher unit into a concrete sump. The crusher units are of the

rotary, four roll type driven by a geared motor unit of 25 b.h.p. This and all other motors in the station were supplied by Lancashire Dynamo & Crypto, Ltd.

Single stage centrifugal type pumps discharge the ash laden water collected in the sump to one of two halves of an elevated ash drainage bunker located in the station yard. Each half of the bunker has a capacity of 60 tons, and the discharging gates on the outlets are of the water collecting type. Belt conveyors positioned beneath the bunker discharge gates allow the drained ash to be loaded either into railway wagons or lorries for disposal off site. The dust is removed from the Lodge-Cotterell precipitator hoppers by hydraulic ejectors which discharge it into a sluiceway where it is delivered to the ash sump. Dust is removed from the sump by connecting a single stage centrifugal slurry pump in series with the ash pump, the combination disposing of the slurry to worked-out ballast pits situated in the locality. The ash and dust plant was designed and manufactured by B.V.C. Industrial Constructions, Ltd., utilizing pumps by Gwynnes Pumps, Ltd.

Generating Plant

The turbines, which have been constructed by Richardsons, Westgarth & Co., Ltd., to the design of Brown Boveri, Ltd., are three cylinder, simple tandem, impulse reaction machines operating on stop valve steam temperature conditions of 850 deg F at 600 lb/sq in. The blading on the h.p. rotor comprises one row of impulse blades followed by 22 rows of reaction type blades. The i.p. cylinder has 18 rows of reaction type blading while the l.p. section, being of the divided flow type, has two groups of reaction blading each of five rows. The steam conditions at the i.p. and l.p. section inlets are 610 deg F at 190 lb/sq in and 212 deg F at 0·3 lb/sq in respectively. The design steam consumption of the turbines at 100 per cent load is 9·04 lb/kWh with a heat consumption rate of 10,060 B.Th.U/kWh.

The Richardsons, Westgarth condensers comprise twin shell two pass type units, the total cooling surface provided in each pair of shells being 40,000 sq ft. Each unit is designed to condense 219,000 lb/hr of steam and with the feed heating system in operation, the corresponding design vacuum is 28·8in Hg. Under these conditions, the quantity of cooling water required is 23,500 gal/min at an inlet temperature of 65 deg F. To protect the turbo-alternators against loss of vacuum a relay operated device is incorporated in the turbine control which automatically reduces the load progressively in the event of the condenser not being able to maintain a satisfactory low back pressure. The air extraction apparatus comprises standard live steam, jet operated, three stage ejectors with a dry air capacity of 113 lb/hr. The jet steam is condensed by means of two small surface condensers incorporated in the ejector casing through which the condensate is pumped by the extraction pumps. The extraction pumps are vertical spindle electric driven "Pervac" type supplied by Drysdale & Co., Ltd. Each has a capacity of 600 gal/min and there are two per condenser. Each is capable of dealing with the whole of the condensate from the turbine and the cascaded and other drains at m.c.r. including an overload capacity.

The circulating water system is designed to use some of the cooling capacity of the River Lea, since there is sufficient water available to supply the requirements of one set. The river supply is augmented by three Davenport reinforced concrete natural draught cooling towers each capable of dealing with 1·35 million gallons of water per hour. Each tower is supplied by two pumps which draw water from a condenser discharge culvert which is common to all the condensers. The towers discharge, via their own ponds, to a common inlet culvert into which the river water is also drawn. Thus all three towers are in parallel with the river supply and can be used singly or in any combination to suit whichever machines are running.

All the circulating water pumps are manufactured by Mather & Platt, Ltd., and are of the vertical "Lonovane" type.

The four stage feed heating system comprises one combined l.p. heater and drain cooler, one low level de-aerator followed by two stages of h.p. heaters. The feed temperature, when the turbo-alternator is generating at m.c.r., is 350 deg F at the outlet of No. 2 h.p. heater. The l.p. heater and drain cooler has a combined surface of 1,000 sq ft and is of the six pass horizontal low pressure type. The de-aerator is of the flash type with direct contact heating and a horizontal water storage tank. The heating surface is 600 sq ft and the unit has a designed flow quantity of about 340,000 lb/hr. The two vertical four pass U-tube h.p. heaters each have cooling surfaces of 950 sq ft.

The evaporating plant, made by Aiton & Co., Ltd., consists of a vertical straight tube type unit operating with turbine bled steam and also with live steam by the vapour compression method when the turbine is on low load or is shut down. The units are also fitted with raw water preheaters which are capable of raising the temperature of the raw water feed nearly to saturation temperature prior to its entering the evaporators.

The alternators are of C. A. Parsons & Co., Ltd., design and manufacture. The main alternator is rated at 30 MW at 3,000 r.p.m. and is wound for 33 kV, three-phase, 50 c/s generation. The auxiliary alternator which is integral with the main machine, is rated at 2 MW at 3,000 r.p.m. and is wound for 3·3 kV, three-phase, 50 c/s generation. The power factor for the main machine is 0·85 lagging and for the auxiliary alternator 0·8 lagging.

Both machines are air cooled on a closed circuit principle. The system is provided with an alarm device which operates if the cooling air exceeds a specified temperature. The main air cooler is designed to deal with 70,000 cu ft/min when supplied with 900 gal/min of cooling water. Excitation is by means of direct coupled main and pilot exciters and automatic voltage regulators of the normally inactive type function in the excitation circuits of main and auxiliary alternators.

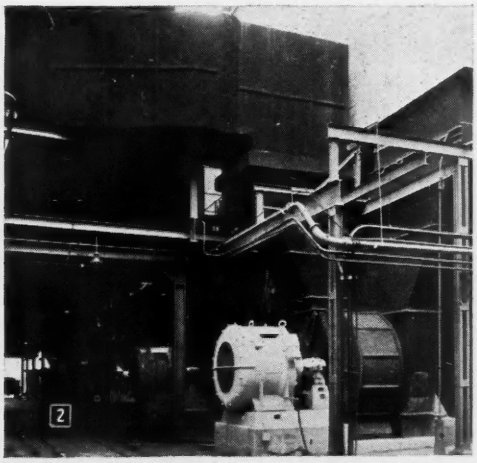
The output of the main alternators at 33 kV is switched direct on to the busbars of the main switchgear, which is of the B.T.H. outdoor type. The rupturing capacity is 1,000 MVA and it is arranged in two groups of double busbar form having two oil circuit breakers per circuit. The grid supply is obtained by stepping up the voltage from 33 kV to 132 kV through four 45 MVA transformers, which also function as reactor couplings between the two groups of switchgear.

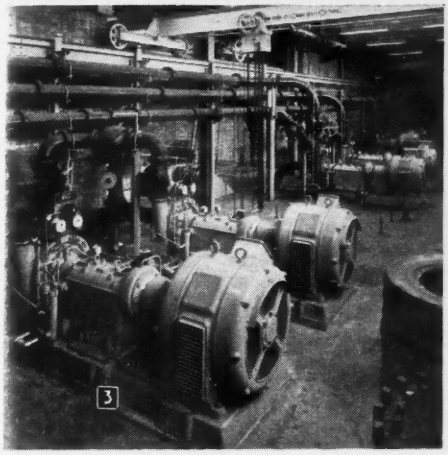
In addition to the direct coupled house service alternators, supplies for works power auxiliaries are also derived from the 33 kV busbars through one 3 MVA transformer per alternator which supply 3 kV double busbar works switchboards. The essential auxiliary plant is divided equally between these two supplies. The 3·3 kV supply is again stepped down as required for the low voltage auxiliaries.

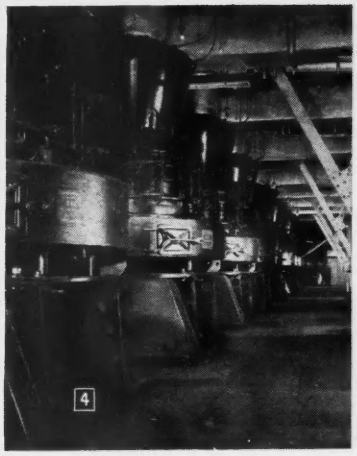
In the control room the panels are of the semi-miniature type, each carrying its own alarm annunciator. Synchronizing is carried out at the panels using trolley mounted equipment but running control is from a centrally mounted desk. This desk also carries the turbine and boiler house telegraph transmitters and has logging facilities for the two control engineers. Main metering equipment and printometers are housed in a separate chamber adjacent to the control room. Extensive use is made of fluorescent lighting throughout the station, this being supplied by Thorn Electrical Industries.

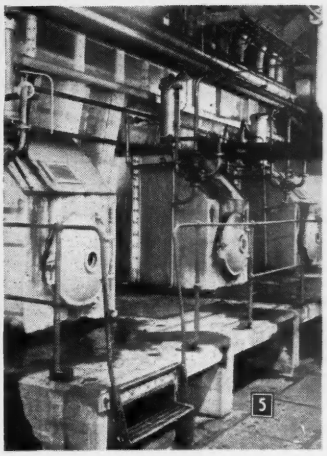
Indian Railway Electrification

AS the first stage of a scheme for electrifying the suburban lines around Calcutta, the Government of India has sanctioned an expenditure of Rs 118·6 million on the electrification of the line between Howrah and Burdwan via Bandel and the branch line from Sheoraphuli to Tarakeshwar in West Bengal. *Indian Trade and Industry*, reporting this, says that the scheme, when completed, should greatly reduce traffic congestion on the Howrah–Burdwan section and also enable more people to move out of the crowded city into the suburbs. Work on the scheme is expected to begin shortly and to be completed in three years. The Howrah–Burdwan line is 66 miles long and that from Sheoraphuli to Tarakeshwar nearly 22 miles.



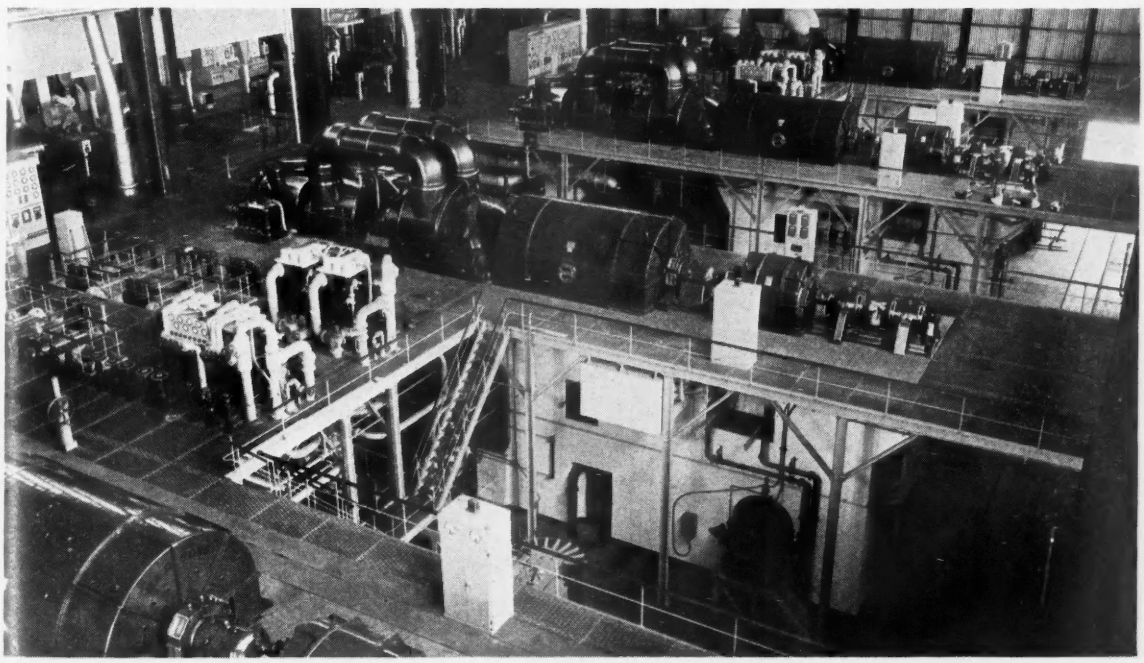






(1) *In the control room the panels are of the semi-miniature type, each carrying its own alarm annunciator.* **(2)** *The induced draught fans are of double inlet design and there are two units per boiler.* **(3)** *Some of the feed pumps.* **(4)** *Each boiler is fed with pulverized fuel from four B. & W. mills.* **(5)** *The ash hoppers are of the hydrojet type designed for side discharge into the sluiceway*

General view of the turbine room showing the turbine and boiler controls in the background



PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. D. G. Lindsay, A.M.I.E.E., of Alexander Lindsay, Ltd., Glasgow, has been appointed to represent the Electrical Contractors' Association of Scotland on the Electrical Fair Trading Council in place of **Mr. J. D. D. Shaw.**

Mr. I. S. G. Mackenzie, M.B.E., has been appointed to the new post of director of labour and welfare of the North West, Merseyside and North Wales Division of the British Electricity Authority, and it is expected that he will take up his new duties on 1st September. He has, since 1949, been secretary to the Midlands and East Midlands District Joint Advisory Councils of the industry. Educated at Kings Mead, Seaford, Sussex, and Trent College, Derbyshire, Mr. Mackenzie was for ten years with the Eastern Telegraph Co., Ltd. (now Cable and Wireless). After passing through workshop and operating training, he served first on the technical and then on the administrative staff; his work included the initiation and running of the training school. War service interrupted Mr. Mackenzie's appointment as office manager for the Imperial Tobacco Co., Ltd., in London, but on demobilization he was made personnel manager of that company's Liverpool factory. He served with the Royal Corps of Signals from 1939 to 1945 and was awarded the M.B.E. (Military) in 1944.

Mr. I. S. G. Mackenzie

Mr. E. Castleton Elliott, F.S.A.A., previously deputy chairman, has been appointed chairman of Kerry's (Great Britain), Ltd., and its subsidiaries, in succession to the late **Mr. E. P. Richardson.**

Mr. P. O. Wymer, who has been Press officer to the E.M.I. group of companies since 1948, relinquishes that appointment at the end of July in order to take up a new post in the radio industry. He will be succeeded by **Mr. H. J. Dyer,** a journalist and publicist who has had a long connection with the industry, the B.B.C. and the Press. Among other activities, he was a former editor of the "Wireless and Electrical Trader"; he was largely concerned in the formation of the Public Relations Committee of the Radio Industry Council, and was also for some years a member of the R.I.C. Exhibition Organizing Committee.

Councillor L. Wall, Birmingham manager of Electrical Components, Ltd., has been appointed to represent Sutton Coldfield Borough Council on the Electricity Consultative Council, No. 4 (Birmingham and District) Local Committee, for the ensuing year.

Mr. S. Roberts has been appointed deputy managing director and general sales manager of Hoover, Ltd. Mr. Roberts was appointed a director of the company at a board meeting held on the 15th July last. He joined the company in 1929 as a representative, since when he has served in various positions in the sales organization. Since he was appointed a director of Hoover (Washing Machines), Ltd., in 1950, he has been responsible for the company's sales policy. Mr. Roberts' appointment follows the resignation of **Mr. F. H. Bunn,** who has retired after thirty-three years' service. Mr. Bunn has been director and general sales manager of Hoover, Ltd., since 1946.

The General Electric Co., Ltd., has announced the following appointments:—**Mr. J. B. Taylor,** T.D., manager of the Leicester Branch, to be managing director of the British General Electric Co. (Canadian), Ltd.; **Mr. J. S. Langlands,** managing director, British General Electric Co. (Canadian), Ltd., to be district assistant manager, G.E.C., Scotland; and **Mr. K. L. V. Nichols,** of the Ipswich Branch, to be manager of the Leicester Branch.

Mr. Taylor joined the G.E.C. in 1936 and for the past five years has been manager of the company's Leicester Branch. He has been secretary of the Leicestershire Branch of the Electrical Industries Benevolent Association and in addition has served on the committees of various other electrical associations. A pre-war Territorial officer, Mr. Taylor commanded a battalion of the Royal Warwickshire Regiment, and saw service in Burma and the Far East.

Mr. J. B. Taylor

Mr. K. L. V. Nichols

After the war, he raised a regiment of Mobile Heavy Anti-Aircraft Artillery which he commanded until 1950.

Mr. Nichols joined the General Electric Co., Ltd., in November, 1928 as a trainee at head office and, in 1934, was appointed to the company's Ipswich Branch. After war service, he resumed his duties in Suffolk and upon the nationalization of the electricity supply industry, was appointed liaison officer to the Eastern Electricity Board. Later, in 1951, he was appointed sales supervisor for the Eastern Counties. He was chairman of the Ipswich and District Electrical Association in 1947, and up to the time of his Leicester appointment chairman of the Suffolk Branch of the E.I.B.A.

The president-elect of the London Branch of the Association of Mining Electrical and Mechanical Engineers is **Mr. C. A. C. Hillyer,** a member of the engineering staff at the Willesden switchgear works of the British Thomson-Houston Co., Ltd. Mr. Hillyer, who will take office in October, served his apprenticeship with the B.T.H. Co. from 1919 to 1924 and, apart from three years with Johnson & Phillips, Ltd., at Charlton (1925-28), has been with the company at Willesden ever since, taking charge of mining and flameproof switchgear design in 1935 and being responsible for heavy metal-clad switchgear development since 1946. He has been a member of the A.M.E.M.E. since 1945 and a committee member of the London Branch since 1949.

Mr. C. A. C. Hillyer

Mr. O. D. Angell, senior partner of Belisha & Co., stockbrokers, has joined the board of the British Vacuum Cleaner & Engineering Co., Ltd.

Mr. F. Foulkes has been re-elected general president of the Electrical Trades Union for a further five years.

Mr. L. C. Jarman, A.M.I.E.E., A.M.I.Prod.E., has just joined Metal Industries, Ltd., as group personnel officer responsible for training, education and welfare work for all the companies in the Electrical, Engineering and Metals Divisions. Mr. Jarman has held similar positions with the Merseyside & North Wales

Electricity Board and with Richard Thomas & Baldwins, Ltd., and before the war was on the technical staff of Brookhirst Switchgear, Ltd., one of the Metal Industries group.

Mr. S. A. Riley is resigning his position as general manager of Foreight Productions, Ltd., having accepted an appointment with the Air Ministry which he takes up in mid-August. Mr. Riley was formerly for many years with Mann, Egerton & Co., Ltd., Norwich, as general manager of the company's electrical contracting division.

The Merseyside Area Competition in connection with the **E.I.B.A. National Golf Championship** is to be played at Heswall Golf Course on 1st September. The major competition will be played during the morning, and a greensome during the afternoon. Entries should be sent without delay to Mr. S. Roy Gee, 29, Hope Street, Liverpool, 1.

London Transport has announced that **Mr. L. A. M. Ginger,** A.M.I.E.E., has been appointed assistant chief electrical engineer. Before joining London Transport, Mr. Ginger was assistant for substations and cables in the office of the electrical engineer (new works and development), Railway Executive, and was largely responsible for the design and layout of the substations and distribution systems for the Liverpool Street to Shenfield and the Manchester, Sheffield and Wath electrification schemes. In 1950 he was appointed assistant electrical engineer (outdoor), with responsibility for the co-ordination of the operation and maintenance of the generating stations, substations, h.v. mains and distribution sections of London Transport's power supply system.

Mr. H. Branton, generating station superintendent (Lots Road), has been appointed assistant electrical engineer (generation) with responsibility for the work in connection with all three of London Transport's generating stations (Lots Road, Neasden and Greenwich). Mr. Branton joined the Metropolitan Railway in 1930 as assistant resident engineer at Neasden, becoming resident engineer three years later, and assistant electrical engineer in charge of the generating station in 1940, a position redesignated generating station superintendent in 1950. In 1951 Mr. Branton was appointed generating station superintendent at Lots Road.

Mr. L. A. M. Ginger

Mr. H. Branton

Viscount Falmouth, M.I.Mech.E., has been re-elected president of the British Internal Combustion Engine Research Association.

The annual ball of the Hants and Dorset Branch of the **Electrical Industries Benevolent Association** will take place at the South Parade Pier Pavilion, Southsea, on 25th November.

Mr. William Casson, M.I.E.E., since 1953 system design and development engineer in the Transmission Design Branch of the British Electricity Authority, has been appointed transmission design engineer of the Authority in succession to **Mr. F. J. Lane,** O.B.E., M.Sc., M.I.E.E., who was recently appointed deputy chief engineer (transmission). Mr. Casson was born at Stockport in 1902 and received his technical training at the Victoria Technical School, Preston, and the Regent Street Polytechnic, London. He was appointed testing assistant to the Metropolitan - Vickers Electrical Co., Ltd., in 1921, deputy meter engineer to the Northmet Co., in 1923, district engineer to Kennedy & Donkin in 1930 and second assistant, Central Electricity Board, South-East and East England Area, in 1934, and later chief assistant technical engineer. He is a joint author of a number of I.E.E. papers and was awarded the Transmission Section (1942) and Silvanus Thompson (1947) Premiums. He was a member of the Measurements Section Committee from 1942 to 1945.

Mr. W. Casson

The first sports day and fête organized by the **Marconi Instruments' Social and Sports Club** was held at the new sports ground at Cotlandswick, near St. Albans, on 3rd July. In addition to the athletic events, there was a flower, fruit and vegetable show, a photographic exhibition, children's corner, and baby show. Due to bad weather, the programme could not be completed, the remaining events taking place the following Friday. Mrs. J. M. Furnival, wife of the general manager of Marconi Instruments, Ltd., presented the prizes.

Following the retirement of **Mr. H. F. Fordham** in June, **Mr. J. Allen** has been appointed manager of the Manchester branch of the Revo Electric Co., Ltd. Mr. Allen has been deputy manager since 1953, and joined the company as senior representative at the Manchester branch in 1946. Previously he held positions with the Electricity Departments of Southport and Bury Corporations. Mr. H. F. Fordham's retirement concludes over twenty years' service with the company.

Mr. H. F. Fordham

Mr. J. Allen

The Apprenticeship and Training Council for the Electrical Contracting Industry has awarded scholarships for 1954 to two 19-year-old apprentices, **Mr. A. W. J. Venn,** a student at Bristol College of Technology and employed by the Colston Electric Co., Ltd., and **Mr. B. Lott,** a student at Burnley Municipal College and employed by Meeder's Electrical Services. The scholarships are tenable for three years for degree courses at a university or for higher national diploma courses at a technical college, and cover fees, examination expenses and maintenance allowances. The awards were presented by Sir David Eccles, Minister of Works, at the London County Hall on Monday last.

Sir George Gater, chairman of the Apprenticeship and Training Council for the Electrical Contracting Industry, welcomed Sir David Eccles and Mr. Victor Mishcon, chairman of the London County Council, who also attended the presentation of the awards. Handing the prizewinners their certificates of awards, Sir David said that 9,000 apprentices were now registered under the training scheme and 200 more were being registered every month. He emphasized the necessity for getting a better team spirit in the building industry as a whole and he hoped that the prizewinners would see a more corporate spirit introduced leading to increased efficiency and high wages. Proposing a vote of thanks to Sir David, Mr. R. A. Marryat, a member of the Council, mentioned that the rebuilding of cities with its tremendous amount of wiring had only just begun and a new era of electrical development had dawned overseas. The training scheme encouraged youngsters to hold positions of superior capacity and there was now a considerable demand for men of high qualifications in the industry. Mr. R. G. McLennan, another member of the Council, seconded the vote of thanks and said that there was no lack of boys wishing to enter the industry.

About 800 people attended the annual athletic meeting, organized by the **Ekco Social and Sports Club,** which was held at the Ekco Sports Ground, Southend-on-Sea, on 10th July. Among those present was Mr.

E. K. Cole, chairman and managing director of E. K. Cole, Ltd., and president of the Club. For the first time the Ekco Malmesbury (Wiltshire) and Canvey Island (Essex) factories participated; the Club Shield was won by the Radio Division, of Southend.

On 14th July, in the Ekco Clubhouse, Southend-on-Sea, Mr. E. K. Cole, chairman and managing director of **E. K. Cole, Ltd.**, presented gold watches to Mr. A. C. Segger and Mr. C. R. Godsill, production manager and assembly superintendent, respectively, of the Ekco Southend radio factory, and Mr. A. P. Impey, a senior wage clerk at Southend, to mark their twenty-five years' association with the company.

Mr. George Ellison, founder and chairman of George Ellison, Ltd., and Mrs. Ellison celebrated in Switzerland

Mr. and Mrs. George Ellison

on 21st July the diamond anniversary of their wedding. Mr. Ellison is also chairman of the associated companies, Tufnol, Ltd., and Alfred Ellison, Ltd. Mr. and Mrs. Ellison were married in the United States in 1894 and they have fours sons and one daughter. Three of the sons assist Mr. Ellison in the governing of the Ellison associated companies. George Ellison, Ltd., was founded in Birmingham by Mr. Ellison in 1906 and in 1929 he founded Tufnol, Ltd., under its former name of Ellison Insulations, Ltd. He is a life governor of the University of Birmingham.

The annual family day and children's gala, arranged by **Henley's Sports Club** (Gravesend), was held on 10th July, a large number of Henley's employees, their wives, children, and friends enjoying an excellent programme at the company's sports ground at King's Farm Estate, Gravesend. The programme included sports for adults and children, a tea party for nearly 600 children, a children's fancy dress parade, and a variety of displays, contests and amusements.

Heavy rain made conditions so bad at Coventry Golf Club's course at Finham Park on 15th July that only four out of fourteen competitors in the **Midlands Radio Industry** Golfing Society's medal competition for the C. O. Stanley Cup finished the round. Winner was the Society's vice-captain, Mr. B. J. Taylor, who returned a net 81. Runner-up was Mr. A. R. A. Wood, with a net 82.

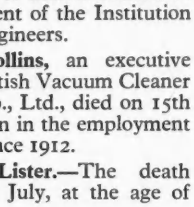
OBITUARY

Mr. Albert Edward Erickson, mining superintendent in the Home Sales Department of the Automatic Telephone & Electric Co., Ltd., died on 8th July at his home in Broad Green, Liverpool, at the age of fifty-six. Mr. Erickson joined the company in 1919 as a draughtsman-designer. As a result of his early work on the design of mine telephones and signalling equipment he was recognized as among the foremost authorities in the country on this subject. During the past twenty years he had represented the company in the mining areas. He was a Fellow of the Association of Mining Electrical and Mechanical Engineers.

Sir Ernest Willoughby Petter, who with his brother, Mr. P. W. Petter, founded the firm of Petters, Ltd., and designed and built what they believed to be the first internal combustion motor-car engine in this country, died at New Milton, Hampshire, on 18th July at the age of eighty-one. He ceased active association with the company on its merging in the Brush Group. Sir Ernest was formerly president of the British Engineers' Association, a member of the executive of the Federation of British Industries and a vice-president of the Institution of Mechanical Engineers.

Mr. C. B. Collins, an executive director of the British Vacuum Cleaner & Engineering Co., Ltd., died on 15th July. He had been in the employment of the company since 1912.

Mr. T. F. Lister.—The death occurred on 13th July, at the age of seventy-one, of Mr. Thomas F. Lister, chairman of Hackbridge & Hewittic Electric Co., Ltd. Mr. Lister was born at Brighouse, and following his engineering training at Halifax Technical School, he commenced his career at a small engineering firm in Yorkshire in 1898. Three years later he joined Ferranti, Ltd., and after only a few months at Hollinwood was transferred to the Contracts Department of the London Office. This office was closed down in 1904, and he then joined the General Electric Co., Ltd., at Queen Victoria Street for a few months.



The late Mr. T. F. Lister

In 1905 Mr. Lister joined the Metropolitan-Vickers Electric Co., Ltd. (then British-Westinghouse), where he remained for twenty years. During this time he gained valuable experience in the large machine division, switchgear, transformer, and meter departments and, during the 1914-18 war, he had charge of the Deep-Sea Mining Department and the Magneto Department. After the war, when a Main Production Department was started covering the whole of the Trafford Park Works, Mr. Lister was appointed first superintendent, a position he held until 1925, when he left Trafford Park to take up the position of manager of the Hackbridge Electric Construction Co., Ltd., at Walton-on-Thames. In 1926 he was appointed manager also to the Hewittic Electric Co., Ltd., becoming director of both companies in 1933, managing director of these companies and also the New Switchgear Construction Co., Ltd., in 1944, and chairman and managing director in 1946. In 1947-48 he was made chairman and managing director of the newly amalgamated group under the title of the Hackbridge & Hewittic Electric Co., Ltd. He retired from the position of managing director in March, 1954, but remained chairman of the company.

Mr. Lister was well known in the electrical industry and among his many interests was his association with the British Electrical and Allied Manufacturers' Association, of which he was chairman of the Council in 1951 and 1952. He took a great interest in youth education and was a governor of Brooklands Technical College, Weybridge.

WILLS

Mr. C. A. Clench, M.I.Mech.E., M.Inst.F., chief generation engineer (construction) of the London Division of the British Electricity Authority, who died on 3rd April, left £13,723 gross (£10,596 net).

Mr. M. G. Drake, A.M.I.E.E., formerly managing director of Drake & Gorham, Ltd., who died on 17th January, left £12,933 gross (£12,829 net).

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £156 0s 0d
COPPER, H.C. Electro	ton £240 5s 0d
Fire Refined 99·70%	ton £239 0s 0d
Fire Refined 99·50%	ton £238 0s 0d
COPPER Tubes ..	lb 2s 3½d
Sheet	ton £299 15s 0d
H.C. wire and strip ..	ton £268 15s 0d
LEAD, English ..	ton £96 5s 0d
Foreign	ton £96 0s 0d
MERCURY	flask £100 0s 0d
TIN, block (English) ..	ton £769 0s 0d
ZINC, G.O.B. Foreign	ton £77 15s 0d
Electrolytic	ton £89 0s 0d
BRASS Tubes (solid drawn)	lb 1s 10½d
Sheet	ton £245 10s 0d
Wire	lb 2s 6½d
PHOSPHOR BRONZE Wire	lb 3s 9½d
PLATINUM	oz £30 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 20½d–20⅝d

INDUSTRY AND THE HOUSE

Debate on the Borrowing Powers Bill

By A. M. F. PALMER, A.M.I.E.E., M.P.

AS predicted in my last article, the Gas and Electricity (Borrowing Powers) Bill turned out to be an occasion convenient to Conservative back bench "rebels" for voicing their objections to what they regard as the over-great proportion of the nation's capital expenditure devoted to electrical power production. The Bill proposes to raise the borrowing limits for electricity from £700 million to £1,400 million and gas from £250 million to £450 million.

Sir Gurney Braithwaite, an ex-Parliamentary Secretary to the Ministry of Transport, and Viscount Hinchingbrooke, Member for Dorset South—an intellectual, creative, High Tory—moved an amendment approving liberal provision for the development of the country's industrial assets, but declining to give a Second Reading to a measure which brought such advantage to electricity and gas while restrictions continued on the development of other important projects. It soon was plain that by "other projects" Sir Gurney meant mainly road building and improvement. He said that when he proposed a £500 million loan for road development earlier this year it was objected that the amount would disrupt the money market. But here was a scheme for £900 million of new money: why should £500 million cause destruction on 28th May and £900 million construction on 9th July? The capital investment programme had fallen out of gear. If road improvements could not be financed out of revenue they should receive the same facilities as the gas and electricity industries were now getting.

Lord Hinchingbrooke's Views

Lord Hinchingbrooke was openly hostile to electricity. He apparently thinks the industry to be large, overwhelming and materialistic; it encourages people to live in a false, nationalized, "all-electric glitter."

He told the House that when industries were nationalized it was the end of good internal economy. They expanded them not by practical housekeeping nor by the stimulation of the laws of supply and demand, but by Ministerial direction or because a few able civil servants or other influential people behind the scenes had the opportunity to work their will. He went on to display a contemporary electrical advertisement showing a handsome young couple sitting by the river discussing, he said, not what was natural and customary, but instead the advantages of a visit to the local electricity showrooms. In a voice charged with apprehension Lord Hinchingbrooke added that the advertisements of the British Electricity Authority were now growing larger all the time!

Earlier the Minister of Fuel and Power, Mr. Geoffrey Lloyd, in a detailed speech had pointed out that the expenditure allowed for by the Bill was necessary to complete the reorganization and renovation of the fuel and power industries which would lead to better service, greater efficiency and more economical use of coal. The expansion of the electricity supply industry would prepare the way for the peaceful application of nuclear energy; already the B.E.A. had established a nuclear power branch in its engineering department.

He went on to say that until nuclear power could make its "massive contribution" the country needed some other supplement to "lighten the load" on the coal industry. Oil, he thought, was the only commodity capable of filling the gap. Mr. Lloyd then announced that the B.E.A. intended to equip Marchwood power station on Southampton Water with dual-firing apparatus for either coal or oil. The Esso Petroleum Company was prepared to supply oil at a price which made it no more expensive than coal.

The debate—generally on a high level—continued throughout Friday's sitting time. Conservative speakers mainly developed the theme that capital investment could best be regulated by the free play of the market; Labour speakers supported the Minister in the assumption that basic investment had to be organized if national productivity was to be raised and higher living standards obtained. Mr. Joynson-Hicks, the Parliamentary Secretary, in reply said that critics failed to appreciate the extent of the supervision over public capital issues. Control in the public sector of industry was probably tighter than for private enterprise because the former was directly under the Chancellor of the Exchequer. In the past five years the average capital investment of the gas and electricity industries had represented about 10 per cent of the total capital investment; he thought this not too much by any measure.

For the general public and the lay Press, the high-light of the day was the surprise announcement that it is proposed to have an independent inquiry into the working of the nationalized electricity supply industry since Vesting Day. Sir Edwin Herbert is to preside over a mixed team of industrialists and economists with Mr. Jack Tanner, Chairman of the T.U.C., sitting in for the trade unions. The Labour Opposition officially welcomes the inquiry, regarding it not as an implied censure on nationalization, but as a necessary routine check now that the seven-year period, mentioned by Mr. Herbert Morrison as a suitable interval, is elapsing.

Considering the rebuff that the trade unions and staff associations received when they wished to bring their views before the Self or Carpenter internal inquiry, it is encouraging to note that a question asked during the debate was answered by the Parliamentary Secretary to the effect that trade union opinion would be welcomed by the Herbert Committee.

Progress of Scottish Bill

As if to emphasize the point that the electricity Inquiry is not to concern itself with Scotland, the Electricity Reorganization (Scotland) Bill has now completed its remaining stages in the House of Commons and has left for the "Other Place." Few Bills have moved at such a leisurely pace through the House as this measure to establish an autonomous Electricity Board in Southern Scotland; the Second Reading was obtained in the far-off days of February, over five months ago.

It will be remembered that clauses 4 and 5, which provided separate regional executives in East and West Scotland, were greatly battered by Opposition criticism in

the intervening Committee stage. Speakers then argued that it was cumbersome and administratively unsound to decide beforehand a set pattern of organization by statute. The new Board should be left, when appointed, to devise the best form of organization as circumstances warranted. However, Ministers had stubbornly defended clauses 4 and 5 through twenty-two columns of Hansard in Committee until on Monday last the Secretary of State (Mr. James Stuart) announced his conversion and the withdrawal of the offending clauses. Nobody complained when the Opposition raised a chorus of " We told you so," certainly not Mr. Stuart, who took it all very well. In winding up he said that the Government's object in introducing the Bill was to obtain closer contact with the consumer and to see that his needs, which Scottish Members understood best, were attended to as far as possible. It was proposed to do that by having an organization in Scotland separate from the B.E.A. and the Ministry of Fuel and Power, with a " committee of Scotsmen " in charge.

Questions about trade between Britain and Iron Curtain countries are now of frequent occurrence on the order paper. Mr. Leslie Hale, Labour Member for Oldham West, for instance, asked the President of the Board of Trade recently what quotas for the export of diesel generators of 750 kW and above had been agreed upon by the Committee which regulates such exports from countries in West Europe, meaning countries which are included in the various defence understandings.

Mr. Heathcoat Amory, for the Board of Trade, replied that it was not the practice to make public information of this kind. Further questioning brought from him the admission that controls on exports to Russia were at present being reviewed, although in the case of China controls were necessarily more stringent because prohibited items could be put to direct military use immediately. The Minister thought that any general relaxation of China trade controls must necessarily depend upon political settlements in the Far East.

Scottish Reorganization

IN the House of Commons last week, Mr. Henderson Stewart, Under-Secretary, Scottish Office, formally moved the third reading of the Electricity Reorganization (Scotland) Bill, under which the functions now performed by the Minister of Fuel and Power in relation to electricity in Scotland will be transferred to the Secretary of State for Scotland.

Those functions, he said, would go to an all-purpose board in the South of Scotland, which would be responsible for both the generation and distribution. The North of Scotland Board would remain virtually untouched by the reorganization, though in many respects its contacts would be with the other Scottish Board and not with the B.E.A. The Bill would not affect in the slightest way the broad working of the grid. There would still be an interflow of power north and south just as there was now and as there had been. It might well be that there would be more interplay in the days to come.

As regards negotiating machinery, by the amended provisions of the Bill the Central Electricity Authority—as it would in future be called—the North of Scotland Board and the South of Scotland Board would have a duty jointly to seek consultation with any organization—that was, a trade union—appearing to them to be appropriate with a view to making joint agreements with that organization. He was glad that they had been able so amicably to come to a common view on that point.

They had also been able to achieve accord on the administrative arrangements of the Board. In appointing the members of the new Board, the Secretary of State for Scotland had already given an assurance that he would bear in mind and act on the same principles as he had done in the case of the North of Scotland Board.

The changes made in the Bill had not affected its main purpose, which was to complete the devolution to Scottish authorities of control of the generation and supply of electricity in Scotland. By bringing both the generation and distribution of electricity into the same hands, closer attention could be paid to the needs of the South of Scotland Area as a whole.

After the debate, Mr. James Stuart, Secretary of State for Scotland, said that the Government's object in introducing the Bill and in achieving a measure of decentralization was to obtain closer contact with the consumer. It was proposed to do that by having an organization in Scotland, by taking the duties out of the hands of the British Electricity Authority and the Minister of Fuel and Power, and by having a committee of Scotsmen managing the concern in Scotland.

Mr. Stuart said that his contact with the new Board would be direct and be precisely the same as that with the North of Scotland Hydro-Electric Board. Clause 12 of the Bill gave the new Board power to borrow £75 million for new development in electricity generation and distribution. It did not cover any expenditure already incurred by the B.E.A. and the Area Boards, and he believed it would be sufficient to tide over development for the next four years.

The Bill was read the third time and passed.

Borrowing Powers Bill

IN the House of Commons on Friday Mr. Joynson-Hicks, Parliamentary Secretary, Ministry of Fuel and Power, gave some further information regarding the Gas and Electricity (Borrowing Powers) Bill.

When the Money Resolution in connection with the Bill was considered on the report stage, Mr. Joynson-Hicks said that the Treasury guarantee was being increased in order to meet the borrowing powers which would be sanctioned by the Minister, with the approval of the Chancellor of the Exchequer. Those powers would be increased from the £700 million contained in the previous Act in the case of electricity, that sum having been approximately exhausted, to £1,400 million for the future.

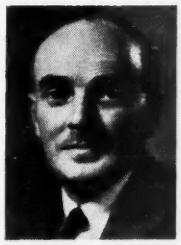
The resolution was agreed to on report.

When the Bill was considered in Committee, Mr. Leslie Hale, speaking on clause 1 (Extension of Borrowing Powers) said there was natural concern about the provision of electricity for rural development and the development of agricultural production. Those who represented industrial constituencies were concerned about electrical development for the production of the basic needs of the towns. All of them were concerned with the vital matter of the electrification of the railways. We were lagging behind the industrialized world. Our railway services were lamentable as a result of years of war as well as lack of development. The allocation of a considerable proportion of the development sum to the electrification of the railways was a matter of great importance. Before the British railways could be electrified the electricity must be provided. The whole problem of the provision of electricity was a great responsibility of the Minister of Fuel and Power. The project for electrifying the railways would clearly mean a diminution of coal consumption. The Minister should give some indication of the type of balanced electrical development he desired to provide and how much was to be allocated to industrial productivity.

Mr. Joynson-Hicks, replying to the debate, said it was not the Minister's responsibility to electrify the railways, nor was the electrification of the railways a subject matter to be dealt with under the Bill. The Minister's responsibility, so far as that Bill was concerned, was to see that adequate money was available for the provision of electricity in the event of a decision being undertaken elsewhere to electrify the railways.

The clause was agreed to, the Committee stage was concluded, and the Bill was read the third time.

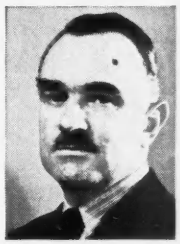
Mr. J. Eccles



Dr. Willis Jackson

Sir Gordon Radley

Mr. H. W. Grimmitt



Mr. A. R. Cooper

I.E.E. ELECTIONS

New President, Council and Section Officers for 1954–55

MR. J. ECCLES, C.B.E., M.M., B.Sc., M.I.C.E., M.I.Mech.E., deputy chairman (operations) of the British Electricity Authority, and one of the leading figures in the electricity supply industry for many years, has been elected President of the Institution of Electrical Engineers for the ensuing year.

Mr. Eccles was born in Dungannon, Northern Ireland, in 1898 and during the 1914–18 war served in France, being awarded the Military Medal. He received his electrical training with the Metropolitan-Vickers Electrical Co., Ltd., with whom he was associated from 1918 to 1928. He entered the electricity supply industry in the last mentioned year as senior technical assistant in the Edinburgh Corporation Electricity Supply Department of which he became deputy in 1938 and engineer and manager in 1940. In 1943 he went to Liverpool as city electrical engineer and held this position until nationalization when he became chairman of the Merseyside and North Wales Electricity Board. He took up his present position with the B.E.A. on the retirement of Sir John Hacking last year.

Mr. Eccles was president of the Incorporated Municipal Electrical Association in 1947–48 and was a member of the Organizing Committee under the Electricity Act, 1947, and a part-time member of the B.E.A. in 1948–49. He has been prominent in the affairs of the Institution, having served on the Council from 1945 to 1948; he has been a vice-president since 1949. He was chairman of the E.D.A. Council for 1948–49 and was president of the Liverpool Engineering Society for 1950.

To fill the vacancies of vice-president, Mr. Willis Jackson, D.Sc., D.Phil., F.R.S., director of research and education, Metropolitan-Vickers Electrical Co., Ltd., has been elected and Sir Gordon Radley, C.B.E., Ph.D., engineer-in-chief, G.P.O. has been re-elected. Mr. H. W. Grimmitt, deputy chief engineering inspector, Electricity Division, Ministry of Fuel and Power, has been re-elected hon. treasurer.

The vacancies on the Council have been filled as follows:—Mr. A. R. Cooper, M.Eng., controller, North West, Merseyside and North Wales Division, B.E.A., Mr. F. J. Lane, O.B.E., M.Sc., deputy chief engineer (transmission), B.E.A., Sir Hamish D. MacLaren, K.B.E., C.B., D.F.C., LL.D., B.Sc., director of electrical engineering, Admiralty, Mr. W. F. Parker, technical director, Troughton & Young, Ltd., and Mr. E. L. E. Wheatcroft, M.A., partner, Merz & McLellan. Associate Member: Mr. J. H. Westcott, B.Sc.(Eng.), Ph.D., lecturer in electrical engineering, City and Guilds College, Imperial College. Associate: Mr. J. Bennett, contracts manager, A. Reyrolle & Co., Ltd. The Council has co-opted Mr. B. Donkin, B.A. (member) to fill the casual vacancy created by the election of Dr. Willis Jackson as a vice-president before the completion of his term of office as an ordinary member of the Council.

The new officers and committee members of the various Sections are as follows:—

Measurements:—Chairman, Mr. M. Whitehead; vice-chairman, Mr. D. Taylor, M.Sc., Ph.D.; members, Prof. F. Brailsford, Ph.D., B.Sc.(Eng.), Mr. M. Kaufmann, Mr. C. Ryder, Prof. A. Tustin, M.Sc., and Mr. P. Vigoureux, D.Sc.(Eng.).

Radio:—Chairman, Mr. C. W. Oatley, M.A., M.Sc.; vice-chairman, Mr. R. C. G. Williams, Ph.D., B.Sc.(Eng.); members, Messrs. N. C. Robertson, C.M.G., M.B.E., L. Rushforth, M.B.E., B.Sc., and A. M. Thornton, B.Sc. The committee has co-opted Mr. B. N. MacLarty, O.B.E., to fill the casual vacancy created by the election of Dr. Williams as vice-chairman before the completion of his term of office as an ordinary member of committee.

Supply:—Chairman, Mr. J. D. Peattie, B.Sc.; vice-chairmen, Mr. L. Drucquer and Prof. M. G. Say, Ph.D., M.Sc.; members, Messrs. H. G. Bell, M.Sc.Tech., L. Gosland, B.Sc., L. C. Richards, B.Sc.Tech., and L. H. Welch, B.Sc.(Eng.).

Utilization:—Chairman, Mr. J. I. Bernard, B.Sc.Tech.; vice-chairmen, Messrs. H. J. Gibson, B.Sc., and D. B. Hogg, M.B.E., T.D.; members, Messrs. G. H. Davidson, P. T. Fletcher, B.Sc.(Eng.), A. H. McQueen and R. A. Marryat, B.Sc.(Eng.). The committee has co-opted Mr. R. H. M. Barkham, B.Sc.(Eng.), to fill the casual vacancy created by the election of Mr. Hogg as vice-chairman, before the completion of his term of office as an ordinary member.

Mr. F. J. Lane

Sir Hamish D. MacLaren

Mr. W. F. Parker

Mr. E. L. E. Wheatcroft

Mr. J. Bennett

Kent and Sussex Shows

"Seeboard" Displays at Maidstone and Eastbourne

As the dates of the Kent and Sussex County Shows (which were held at Maidstone and Eastbourne respectively) coincided last week the South Eastern Electricity Board, instead of being able to follow its customary practice of using the same layout for both events, had to duplicate its effort and produce two practically identical displays differing only in minor details. Inevitably these displays were somewhat smaller than usual but nevertheless they succeeded in representing in an interesting and compact form most of the main aspects of farm electrification.

Occupying a prominent position at the entrance to the exhibit was a large figure personifying "Rural Electricity," which like other display features was made by the Board's own display staff. This figure revolved to indicate that it was "a power of help" in the dairy, grain drying, the barn, pig rearing and the home. All these features were represented by separate displays inside the show tent, where the appearance was greatly enhanced by the employment of maroon, grey and blue colour draping of the sides and roof.

The central feature of the display was a working exhibit demonstrating how easy it was to move large quantities of grain with the aid of electrically operated mechanical and pneumatic conveyors. The scheme also incorporated a winnowing machine and one of the new Martin 3 cwt "Comet Minor" grinders which are operated by 1 h.p. motors. At Maidstone prominence was also given to G.E.C. grain drying equipment and E.D.A. models demonstrating barn hay drying, in-sack and in-silo grain drying, and milling. Similar models intended for Eastbourne did not arrive from Scotland in time for display.

In the dairy section were to be seen a Woolley sterilizer, a Burco water heater, a "Purlec" chilled water in-churn cooler and a "Sumo" pump. An Arnold foster mother, a W. L. Holland wet or dry mash mixer, a Heatrae farm food boiler and infra-red lamps represented equipment for pig and poultry farming.

In the section devoted specially to the needs of the farmer's wife, continuous cooking and laundry demonstrations were given, comfortable seating accommodation being provided for twenty-four persons at each session. Adjacent to the demonstrations were displays pointing out how electricity brings instant, cheap and constant hot water; how refrigeration keeps food fresh; and how electric cooking provides automatic oven and simmering control. A Hoover exhibit dealt with vacuum cleaners and steam irons.

Alongside the main exhibit at Maidstone was the Sub-Area's mobile showroom containing a number of other domestic appliances, including cookers, toasters, mixers, washing machines, ironers, fans and clocks. Also nearby was a Woolley in-sack grain dryer and demonstrations were given of a Webb lawnmower. To handle the milk produced in the showground there was an all-electric model dairy equipped with Electrobloc steam-raisers, sterilizers and water heaters and Frigidaire ice-bank, waterless and in-churn milk coolers.

Among individual exhibitors the many showing domestic and commercial refrigeration equipment included D. P. Toomey & Co., Ltd., the Crescent Cold Storage, Ltd., the Pressed Steel Co., Ltd., the Hartford Electric Co. (Kelvinator distributors), Southern Counties Refrigeration Services, Ltd. (Coldrator and Hotpoint), J. T. Herbert, Ltd. (York Shipley), and J. & E. Hall, Ltd. Other electrical appliances were to be seen on the stands of Sergeant & Parks, Ltd. (Kenwood mixers), Western Incubators, Ltd., H. Martin & Co. (Alfa-Laval milking machines, Churn butter making equipment, and John Percy pig rearing apparatus incorporating a foster mother and infra-red warming) and Drake & Fletcher, Ltd. (various domestic appliances including a new Canadian made Thor rotary ironer).

A soil heating exhibit was another Seeboard attraction at Eastbourne where other electrical exhibits included those of Braine & Paris, Ltd. (domestic apparatus), Louis G. Ford, Ltd. (Bendix home laundries, Dishmaster dish washers, S. N. Bridges tools, etc.), H. J. Galliers (domestic and farm equipment), Wm. Harden (refrigeration apparatus), Hoover, Ltd., Insulations & Constructions, Ltd. ("Cresta" food preparation appliances), Kenwood Electrics, Ltd. (domestic food mixers and steam irons), Purlac Equipment, Ltd. (in-churn milk coolers), D. P. Toomey & Co., Ltd. ("Frigidaire" apparatus), Weycroft Dairy Equipment (in-churn coolers) and Workman, Reed & Co., Ltd. ("Beacon-light" automatic generating plant).

The barn machinery section at the Kent County Show and (right) a cooking demonstration in progress at the Sussex County Show

INDUSTRIAL ELECTRONICS

British I.R.E. Convention at Oxford

EARLIER this month (8th to 12th July) the British Institution of Radio Engineers held a Convention on Industrial Electronics at Oxford. The six technical sessions, which included some thirty-six papers, dealt in the main with the use of industrial electronic equipment rather than the design and construction of particular types of apparatus.

Digital Computors

After the opening address had been delivered by the President, Mr. W. E. Miller, the first session, which was held under the chairmanship of Mr. L. H. Bedford, was opened by Mr. R. K. Livesley who considered the factors determining the economic use of an automatic digital computor for scientific and engineering problems. The two types of problem, one involving a small amount of repetition work and the other an indefinite amount, were dealt with and the author stressed the necessity for treating the problem by the correct technique. Recommendations were also made for the use of standard programmes which are adaptable to a variety of problems.

Next Messrs. B. D. Dagnall and R. L. Michaelson described the basic theory and mode of operation of a high speed digital computor without reference to details of the electronic circuitry. They gave a complete "programme of instructions" to cause a typical computor to carry out a simple job and briefly discussed the programming of two representative engineering calculations. The reasons for using computors in industry and the consideration which should apply to the choice of machine for different types of work were then discussed by Messrs. W. E. Scott and A. C. D. Haley. They gave examples of both analogue and digital machines and the uses to which they can be put. The advantages and disadvantages of each type were mentioned to encourage a rational approach to the specification and design of computing devices.

After discussing the economic advantages of training air crews on simulator equipment, some of the problems solved by the computors in flying trainers, engine trainers, and track recording was described by Mr. A. E. Cutler. The relative complications of a full flight simulator computor using digital and analogue methods was considered and the analogue type found the most suitable. The use of the building brick principle was dealt with and details of utilization, running time and percentage serviceability given.

Electronic Multiplying Punch

Electronic calculating methods used to replace mechanical methods in punch-card machines were described by Mr. J. H. Lucas with reference to a type of machine known as the electronic multiplying punch (Emp) now coming into production. The author gave an outline of the calculating systems in sterling and decimal machines and also described the general design principles and some features of the circuit design. In similar vein Mr. P. Huggins discussed the need and use of statistical methods for quality control of a continuous industrial process and described some examples of quality control based on statistical technique, but employing a "human" controller. The advantages and disadvantages of converting to automatic operation such control from the engineering and economic points of view were considered and an outline given of some of the circuit techniques employed. Two practical examples were also quoted, one in the bakery industry and one in cable manufacture, of the application of automatic statistical control.

The use of a high speed electronic computor was described by Messrs. A. C. Johnston and S. L. H. Clarke in two systems of equipment for carrying out invoicing, customers' accounts, stock control and wages computation for an organization having 30,000 customers and 2,000 employees. The first system was shown to give the more complete solution to the problems using equipment which has not yet been fully developed. The authors went on to describe how the problems could be solved by a system using equipment which is commercially available. The nature of clerical work and the fundamental requirements of the equipment for doing it automatically were then considered by Mr. T. R. Thompson. He described the types of clerical work and the circumstances in which an electronic calculator could be used and gave details of experience gained from operating a particular equipment.

After the first session Sir John Cockcroft delivered the second Clerk Maxwell Memorial Lecture in which he spoke on the work of Maxwell and traced its applications up to the present day.

X-Rays and Sonics

The second session, for which the chairman was Mr. H. G. Foster, was concerned with the industrial applications of X-rays and sonics. The first paper, which was presented by Mr. F. M. Savage, described a method of measuring wall thickness accurately, where only one surface was accessible. A variable frequency oscillator is used and standing waves are set up between the transducer and the reflecting surface. At the resonant frequency and its harmonics the oscillator anode current increases and the measurement of the frequency interval between these peaks enables the thickness to be calculated.

Improvements in pulse systems of ultrasonic flaw detection in three fields were then described by Mr. G. Bradfield. The first was a mode changer (to change longitudinal waves to shear waves) which is made of heavy material in the form of a laminated assembly and gives better efficiency and discrimination than the usual device. The second was concerned with the damping, loading and circuitry for piezo-electric crystals to give improved discrimination and to reduce the adverse effects of rough surfaces. Finally the author described devices which enabled beams of mechanical waves to be steered from chosen sites to search for flaws.

The basic theory of vegetable tanning and chrome tanning and differences due to particle size involved were then discussed and the effects of ultrasonic fields described by Mr. F. Gutmann. Practical problems both in the laboratory and in subsequent large scale industrial applications were dealt with. Parallels were drawn between tanning and dyeing, and ultrasonic washing was mentioned. The author also gave details of the transducers and oscillators employed.

The operation of an instrument for the analysis of binary gas mixture subsequently described by Mr. E. W. Pulsford, is based on the variation of velocity of sound in a mixture of two gases with the proportions of the mixture. The velocity of sound is determined at a fixed temperature by measuring the resonance frequency of a double Helmholtz resonator containing the mixture. The source of sound is a diaphragm driven electro-magnetically from a variable frequency oscillator; a similar transducer followed by an amplifier and rectifier form the resonance detector. The author described the method of continuous recording of the mixture proportions. A simple servomechanism is used to maintain the condition of resonance and to operate the recorder.

The nature of X-rays and their use in non-destructive testing was next briefly outlined by Mr. J. J. Bliss. He described suitable X-ray tubes and the associated h.v. generators and referred to problems of exposure control and timing. A typical 250 kV industrial X-ray generator was described in some detail, special attention being paid to the control equipment.

The most important factors in obtaining maximum

sensitivity of flaw detection in the radiographic examination of thick specimens are the energy of the radiation and the size of the source, while to obtain reasonably short exposure times a large X-ray output is required. Mr. C. W. Miller showed that optimum results might be expected with equipment operating at an energy of the order of 4 MeV. The development of the travelling wave linear accelerator, which the author described briefly, has made possible compact equipment and its suitability for industrial radiography was discussed.

The increased demand for close control of rolling tolerances in hot or cold strip and sheet steel mills has led to the development of special X-ray thickness measuring equipment. It functions by measuring the absorption of X-rays in the material, and from the results thus obtained, highly accurate deductions can be made regarding the thickness of the strip. Messrs. F. H. Gottfeld and D. Tidbury gave a description of the radiation source, differential detection equipment and reference wedges. The development of fluoroscopy as an inspection method and as an aid to radiography was discussed and the economics of both applications, their advantages and limitations, considered by Mr. E. W. Kowol. A 150 kV mobile fluoroscopic X-ray unit and a 150 kV fine focus unit which permits an enlargement of the image were described. Special problems of fluoroscopy were also discussed, such as the protection and fatigue of the operator, and the subjective element which is introduced by the method.

Nucleonic Instrumentation

Under the chairmanship of Mr. N. C. Robertson, the third session which dealt with nucleonic instrumentation and application was opened by Mr. E. N. Shaw. He described apparatus for the measurement of weight per unit area of very thin materials such as capacitor paper. An alpha source is used in conjunction with an ionization chamber backed off by a similar system. The algebraic sum of the currents is fed into a stable d.c. amplifier and the out of balance reading calibrated in terms of weight. The author investigated the sources of error together with methods of compensation. Results obtained under factory conditions were also discussed.

The performance of beta gauges is normally extremely satisfactory for most applications, but suffers from not having a very fast response. On the other hand, dielectric gauges suffer from a number of drawbacks but they do have a high speed of response. Mr. R. Y. Parry described composite equipment with the stability of a beta gauge and the fast response of a dielectric gauge which has been developed for use in weighing individual cigarettes and controlling the average weight at a rate of 40 per second. The beta gauge uses a balanced double ionization chamber system. The relative merits of gamma-rays and X-rays were then discussed by Mr. L. Mullins with particular reference to the practice and scope of X-rays. He showed that the methods are to a large extent complementary and that gamma-radiography has special features which have assisted in the rapid expansion of the radiographic inspection of castings and welds.

Mr. G. Syke next described a prototype gamma-ray thickness gauge for hot-milled rolling steel strip of 0·05 to 0·30in thickness which uses a scintillation detector and provides distinct reading at short time intervals. Each reading represents the mean thickness of the strips during the preceding interval. The result is displayed on a lamp board and gives a visual picture of the longitudinal profile of each strip. Automatic standardization while no strip is passing through the measuring head is also incorporated. The author also described an adaptation of the above instrument for gauging the wall thickness of hot steel tubes.

Multi-electrode counting tubes have made it possible to count in decimal figures in a manner which is much simpler than those systems using a multiplicity of single thermionic or cold cathode tubes. It is now possible to use these tubes in equipment for counting nuclear particles and radiations and for counting applications in industrial process control with the advantages of direct indication of the number stored, high counting speeds and simple zero resets. The flexibility of the counting tubes and their reliability has encouraged their use in even wider applications. Mr. K. Kandiah assessed the various features of these tubes which make them suitable for some unusual applications.

The characteristics of scintillation counters for the detection of high and low gamma-rays were then discussed by Mr. J. S. Eppstein. He showed that stability problems are caused by changes in e.h.t. voltage and gave a circuit for minimizing the effects of these, thereby making the counter suitable for industrial use. Next Mr. R. B. Stephens discussed the general requirements of instruments for radiation protection with special reference to some equipments having wide application. He discussed the design principles and emphasized such features as reliability, ease of handling and simplicity of control. The final paper of the session was by Mr. D. Taylor who discussed the servicing of nucleonic instruments under factory conditions and considered some of the problems which have arisen in the British Atomic Energy Project. Referring to the annual failure rates of some of the standard instruments he called attention to component failures. It was noted that much progress has been made in improving the reliability and life of some of the newer components such as Geiger-Muller counters, and that the failure rates were highest for the more orthodox such as valves and resistors. The author quoted experiences from British, American and Canadian sources and in reviewing the analyses presented attempted to lay down a number of guiding principles to follow when designing complete instruments.

Sensing Devices and Transducers

Professor E. E. Zepler took the chair for the fourth session which was concerned with electronic sensing devices or transducers. The first paper was presented by Mr. L. W. Blick who described a typical differential transformer and gave a brief outline of the principles underlying its operation and design. Circuits for use with the type of differential transformer given and the influence of the energizing source were discussed. A means of shifting the electrical zero was shown, together with methods for achieving high mechanical sensitivity. A number of standard production transducers using differential transformers were illustrated and these were compared with their mechanical counterparts. The author concluded by briefly describing some complete systems using transducers and outlining a number of their uses.

After a brief survey of the principles and characteristics of photocells and electron multipliers, Mr. J. A. Sargrove considered the advantages of various optical arrangements for different applications. Sharp focus light spot transducers for reflectometers and light scatter transducers for nephelometric determinations were described and reference made to transducers for particle detection in liquids, goniometric applications such as high speed weighing, line following and edge alignment equipments. Methods of smoke detection were then advanced by Mr. R. W. J. Cockram which had been developed from a common basis for arranging for calibration of a photo-cell either for each test or from a sub-standard illumination. Providing the cell characteristics are met in the control circuits, the methods provide a new approach to photometric problems as experienced in production to-day.

The electrical load cell is basically a form of extensometer applied to a tensile or compressive specimen. Any form of extensometer or micrometer indicating device could be employed, but the electrical resistance wire strain gauge is the most convenient for large loads. These load cells were compared in a paper by Mr. D. L. Johnston with other forms of transducer in terms of energy level and conversion efficiency, so that the most suitable type may be chosen for a particular application. Measuring circuits were discussed including those using magnetic amplifiers and transistors, together with automatic self-balancing bridges of high accuracy.

Next Mr. S. Kelly dealt with the development and use of displacement pick-ups and accelerometers using Rochelle salt and barium titanate. By suitable design units can be

produced with constant sensitivity from 1 c/s to better than 20 kc/s, the law being either constant amplitude, constant velocity or constant acceleration. Typical examples are: (*a*) a barium titanate accelerometer with a sensitivity of 20 mV/g from 5 c/s to 12 kc/s; (*b*) a Rochelle salt vibration pick-up with an equal voltage output from 1 c/s to 600 c/s for constant displacement. The author gave details of matching networks to ancillary equipment although he did not deal with specific amplifier design.

Finally, the theory of operation and the construction of resistance wire strain gauges for the measurement of pressure, vibration, acceleration, force and torque were discussed by Mr. J. L. Thompson. He considered the special applications of unbonded gauges and gave practical details of strain gauge technique, making particular reference to methods of fixing gauges to the structures under examination.

Process Control

The fifth session was held under the chairmanship of Mr. J. L. Thompson, vice-president of the Brit. I.R.E., the subject being process control. Mr. C. R. Bates opened the proceedings by dealing with the electronic control of resistance welding. The circuits commonly used for single phase welding controls may be classified into two basic types, (1) leader-follower circuits, and (2) feedback-trigger circuits. The author gave details of these circuits after briefly describing the requirements for control of resistance welding processes. The various welding techniques and applications were explained, together with the electronic control of weld-heat for spot and seam welding. A discussion of various control circuits followed, including " slope control " for welding aluminium and its alloys. In this the rate of change, or slope, of the weld current is accurately governed and yet may be easily varied or adjusted. Circuits for automatic variation of weld current to compensate for changes in supply voltage or welding conditions are described.

A 30-channel instrument described by Mr. F. Holmes is a rapid routine production control unit in the making of non-ferrous alloys. A special feature is the use of a dekatron counter circuit and a printing recorder to register the counts corresponding to the intensity ratios of the selected spectral lines of the constituent elements being measured. The concentrations are then determined from working curves established experimentally for each measuring channel to give the concentration as a function of the count for the corresponding element.

Mr. M. T. Elvy next described some of the commercial applications of electronic heating in respect of wood which have been developed in the furniture and utilization of wood waste branches of the wood working industry. The author gave consideration to applications covering the seasoning of timber, the bonding of laminated structures, flat, curved and moulded plywood sections, tapeless veneer splicing, edge gluing of panel and core stock, spot gluing and assembly gluing.

Mr. H. A. Thomas dealt with the automatic indication and recording of minute concentrations of organic gases in air. The equipment continuously and sequentially samples the atmosphere from 10 points in the plant and gives automatic warning when the methanol concentrations at these points exceed 200 and 1,000 parts in 10^6. A continuous record is also provided.

The travelling wave linear accelerator provides a source from which a beam of electrons having an energy of several MeV can easily be extracted at a reasonably high power level. Bacteria and viruses can be killed by such irradiation and experiments were described by Mr. C. W. Miller which have determined the dosage required. A wide range of contaminated substances can thus be sterilized without undesirable reaction in the material itself. The process is performed after the product has been sealed in its final container which eliminates the risk of contamination. The sterilization of food is also possible.

Assembly and Feeding Operations

Typical processes carried out by human personnel are assembly operations and the feeding of powered machines. Electronic technique provides a means whereby the parameters defining the motion can be specified in a manner that can be rapidly programmed to meet any particular operation. Some of the flexibility of the human hand can be provided by detachable elements which the machine selects automatically during a programme. The remainder of the problem can be reduced to two elements, a joint and a power source, i.e. a muscle. Typical designs were given by Mr. G. T. Baker who said that the solution was well within the scope of existing manufacturing technique. Convenient methods of programming include telephone-type apparatus, punched paper tape and the magnetic drum.

The sixth and final summing up session was held under the chairmanship of Sir Walter Puckey, and a number of delegates to the conference took part in a debate on " Electronics is the Key to Improving and Increasing Production." During the conference there was the usual complement of social events, visits to works, etc.

Hire Purchase Restrictions Removed

HIRE purchase restrictions imposed by the Hire Purchase and Credit Sale Agreements (Control) Orders were lifted on 14th July. These restrictions related to radio and television sets, gramophones, refrigerators, vacuum cleaners and certain other goods. They were imposed in February, 1952, and provided for minimum initial deposits and restricted the repayment periods in hire purchase and credit sale agreements on many articles.

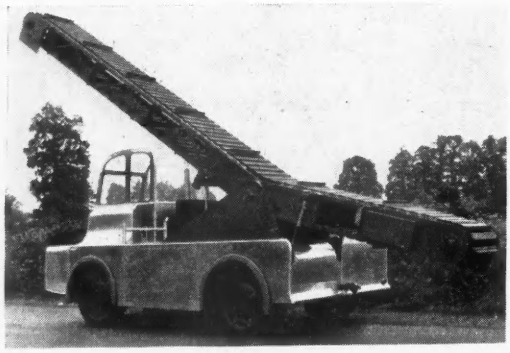
The Orders are now revoked because the Government considers that in to-day's conditions it is no longer appropriate to control the terms of individual agreements for particular articles, but there is no change in the general limitation of finance for hire purchase. The revoking Order is the Hire Purchase and Credit Sale Agreements (Control) (Revocation) Order, S.I. 1954 No. 935 (H.M. Stationery Office, price 2d). The Orders it revokes are:— The Hire Purchase and Credit Sale Agreements (Control) Order, S.I. 1952 No. 121; the Hire Purchase and Credit Sales Agreements (Control) (Amendment) Order, S.I. 1952 No. 724; the Hire Purchase and Credit Sale Agreements (Control) (Amendment No. 3) Order, S.I. 1953 No. 652; and the Hire Purchase and Credit Sale Agreements (Control) (Amendment No. 4) Order, S.I. 1953 No. 1264. For most of the goods controlled by the Orders, the minimum deposit was 33⅓ per cent and the maximum repayment period eighteen months. The revocation of these Orders does not affect the protection afforded to hirers under the Hire Purchase Act, 1938.

Commenting on the Government's decision, a spokesman of the British Electrical and Allied Manufacturers' Association said that for many months past B.E.A.M.A. had been pressing on behalf of the domestic appliance manufacturers, in conjunction with other trade associations, for an easing, or removal, of the hire purchase restrictions which had so unnecessarily hampered the selling of many important household articles. It was very good news indeed that these articles would now be so much more readily available to the housewife and the home market. The benefits, however, would also extend to the export trade, because manufacturers would now be able to go ahead with both their technical and sales plans with a much greater assurance that there would be an increasing home market to reinforce their activities in selling British made domestic electrical appliances to countries overseas.

NEW ELECTRICAL EQUIPMENT

Hinged Boom Conveyor

Although specifically designed for loading and unloading from aircraft, the hinged boom conveyor made by FOURWAYS (ENGINEERS), LTD., New Works, Thornwood Common, Epping, Essex, has almost unlimited applications in speeding up and simplifying operations of this type. It gives variable loading and delivery heights and is mounted on a standard Morrison-Electricar 20 cwt chassis fitted with a 36 cell " Exide " battery of 240 Ah capacity which also provides power to the conveyor unit. The battery box layout gives balanced weight distribution



Fourways hinged boom conveyor

The 21in conveyor track, which is reversible, consists of Renold 4in pitch 6,000 lb breaking strain links having attachments welded to each link carrying hardwood slats and is capable of handling units up to 2 cwt, with a maximum load of 6 cwt, at a speed of 50ft/min. The booms are electro-hydraulically operated, the controls for the conveyor and booms being located in the driver's cab. The platform body has a height of 3ft from ground level, and the driver's cab is of the air-view pattern. A tow-bar is fitted, and there is a seat for the loader behind the cab.

Low-voltage Soldering Tool

A pistol-grip soldering iron, incorporating a thumb mechanism for feeding the solder to the tip, has recently been placed on the market by BUDD & WESTON (SPECIAL MACHINES), LTD., 16, Catherine Place, London, S.W.1.

A hollow carbon tip forms one electrode and the actual solder wire the other. When the iron is in use contact is made and the resultant arc heats the work and the solder to melting point. A feature of the " Solo " soldering iron is that the current (7 A) is consumed only whilst actually soldering. Two mouldings form the case of the tool and these house the mechanism and magazine containing 20ft of solder.

An unsoldering pin in the barrel of the instrument can be brought into use by means of a slide. Heating of the pin is the same as for soldering.

The tool weighs only 12 oz. It is 10in long and is provided with 4ft of two-core flexible. As it is designed for low voltage, the " Solo " can only be used through a transformer or accumulator (6V). The price of the complete unit, including transformer in metal carrying case, is £4 5s; the solder gun alone retails at £1 17s 6d.

" Solo " solder gun

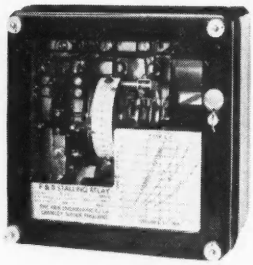
Motor Protective Relay

Induction motors often fail by burning out during a stall. If the overload protection has a time lag that just clears a healthy motor start, but operates on a stall, the motor may still be burnt out by the operator making repeated attempts to restart it at intervals just long enough to reset the relay. This can be overcome by a relay which will operate in the shortest possible time on a stall while not operating on a healthy start, which will not reset too fast, and which will permit restarting, but not repeated attempts to restart should the motor remain stalled.

The P. & B. ENGINEERING CO., LTD., Compton Way, Crawley, Sussex, has produced a motor protective relay which satisfies the foregoing requirements. In its simplest form the relay consists of a contactor and a thermal overload unit. The contactor only closes during the starting of the motor, or if the motor stalls while running.

As long as the contactor is open the thermal unit is short circuited and so cannot operate, but when the contactor closes it switches the thermal unit into circuit and after an interval the thermal unit operates, disconnecting the motor. If, however, the motor current falls to normal before the thermal unit operates, which happens during a healthy motor start, the contactor falls out and cuts out the thermal unit again. After operation the thermal unit resets slowly, giving hot spots in the motor a chance to even out before restarting is possible.

As an optional feature the relay can be supplied with an additional auxiliary contactor having a " twice in " feature. Time settings are obtainable from 5 to 180 seconds. The relay can be supplied for operation with current transformers or for direct connection up to 60 A and is available in flush or projecting pattern cases.



P. & B. motor protective relay

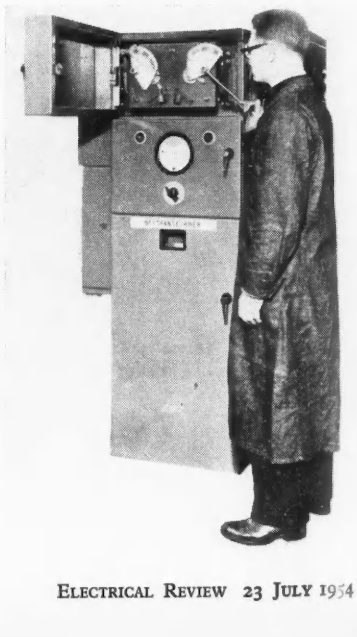
Oil Switch

A new design of oil switch (type OS4/2) has recently been developed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. Complying fully with B.D.S. CR(ELE) 2032, the switch can be supplied in extensible form with air-insulated, compound-insulated or oil-immersed bus-bars, or incorporated in non-extensible ring main units (as illustrated). It is designed for service on 3·3 kV, 6·6 kV or 11 kV systems and has a normal current carrying capacity up to 800 A. The ratings available are 150/250 MVA at 11 kV, 150 MVA at 6·6 kV and 75 MVA at 3·3 kV.

A simple system of interlocking affords complete safety against mal-operation. This takes the form of a slotted disc which must be rotated by hand until the position of the slot permits the desired operation to be performed. Interlocking of the test plugs is accomplished by a moving shutter, which is actuated through a link mechanism designed so that the switch may be moved to " off " when the test plugs are in use. A positive stop prevents the switch being closed in the " on " position while the test plugs are in use.

Fabricated steel cable boxes are provided and are designed to simplify connection, ample space being afforded between the bottom of the box and the floor for cable jointing.

G.E.C. oil switches incorporated in non-extensible ring main unit



The control desk showing the telegraph system and control instruments at the main load control centre at the East Works

Private Industrial Generation

Installations of the Bristol Aeroplane Co., Ltd.

THE diesel generating plant at the Filton and Patchway works of the Bristol Aeroplane Co., Ltd., comprises three separate stations connected to the 11 kV factory distribution system. The plant develops a total of 10,250 kW and is the largest private oil-engined generating plant set up in any factory in Britain since the war. The scheme was originated as a result of the power crisis during the winter of 1946–47. Plans were put in hand for the installation of three 1,200 kW generating sets at the Gypsy Patch site in the Engine Division. The three sets were originally spares for naval frigates and, installed within five months of the start of the scheme, were running before the end of 1947.

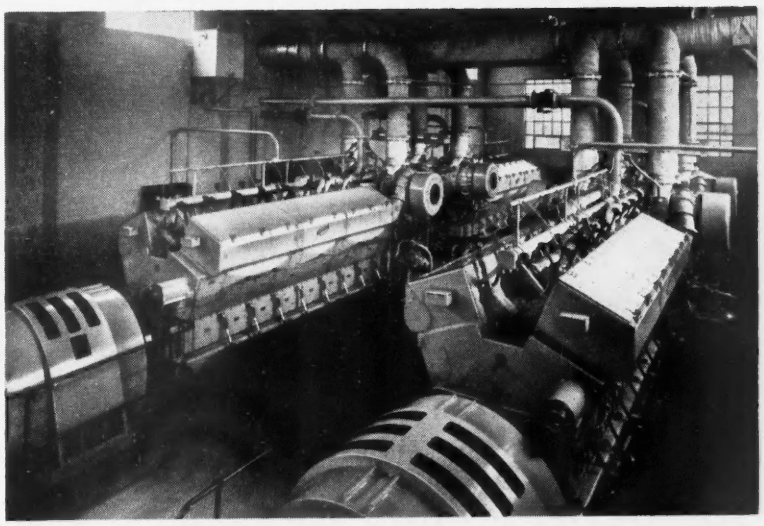
Within a few years the increasing pressure of defence programme commitments and, in particular, the expansion of the company's turbine research programme, made it necessary to more than double the capacity of the supply from the Electricity Board, and for the same reason development of the company's stand-by power supply was desirable. This development took the form of six 1,000 kW diesel alternator plants, four to be installed at the Engine Division's East Works to back up the Gypsy Patch station, and two at Filton to serve the Aircraft Division. Dispersal in this way was necessary for a number of reasons; from the point of view of works defence requirements, use of existing buildings and the technical desirability of siting the sources of power in the areas of greatest need.

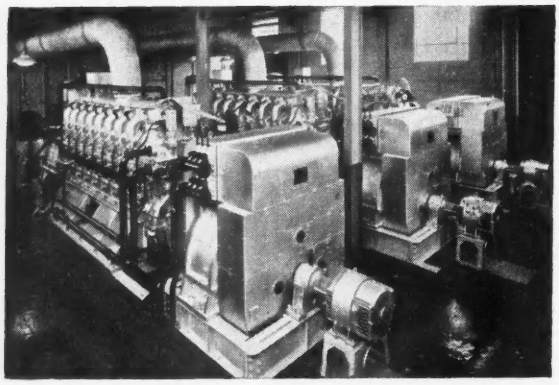
The operation of the three stations is controlled from the East Works power station. Here the operator in charge is provided with equipment which enables him to analyse, forecast and control the use of all electrical power within the company and, by means of special communications, to build up and decrease the generating load as necessary. The operator works in close collaboration with the South Western Electricity Board and all generation is carried out in parallel with the public supply in accordance with general practice. Each generating set is equipped with the necessary protection to meet the supply authority's requirements.

It is interesting to note that the whole arrangement is working in the closest co-operation with the South Western Electricity Board which welcomes this additional generating capacity available for use at times of peak load as well as to meet stand-by requirements. Apart from the main factory's installations there is also a fourth and much smaller station of 216 kW which serves the engine overhaul shops at Whitchurch, on the outskirts of Bristol. All plant has been installed under the supervision of Mr. A. N. Irens, the company's chief electrical engineer, assisted by Mr. J. H. Dawes, generation engineer.

The three major stations contain generating plant of a basically similar type, the chief difference being that the Gypsy Patch station generates d.c., using 2-stroke engines, while East Works and Filton generate a.c. with 4-stroke engines. The Gypsy Patch station was put in hand after the power crisis in 1947 and was partially on load the same year. Three General Motors model 16/278A two-stroke uniflow scavenge 16-cylinder diesel engines, of 1,700 h.p. each, comprise the prime movers and these American engines have performed reasonably satisfactorily during the past seven years. The generators, also of U.S. origin, are of Allis-Chalmers manufacture and operate at 500/550 V at 700/750 r.p.m., the field being separately excited by direct-driven exciters. These machines are very highly rated and are small in size for the output of 1,200 kW. The temperature rise is 70 deg C above ambient. Glass fibre insulation is used to meet these high temperature

General view of the Mirrlees/Brush 1,064 kW alternator sets at the East Works power station





The three General Motors/Allis-Chalmers 1,200 kW generator sets at Gypsy Patch power station

conditions and the heat is dissipated by passing the cooling air in a closed system through a water cooled radiator mounted on top of the generator field yoke.

In the case of sets 1 and 2 the output from each machine is taken to a change-over switching cabinet in the adjacent substation, and is fed direct to the d.c. side of a rotary convertor. The current is then inverted and transformed up to 11 kV and switched on to the h.v. distribution network through "C" type Reyrolle o.c.b. switchgear. The output of No. 2 set is brought direct to the d.c. busbars in the substation and can be either used entirely locally or allowed to swing on to a rotary convertor, thereby partially exporting its current at 11 kV.

It is not possible to switch No. 2 set to the local d.c. load, but No. 1 set, by means of a solid link, can be connected to a special consumer unit at 500 V d.c. independent of the main board. Under these conditions this set supplies stable d.c. for special test purposes and is used considerably in this manner. The maximum load required of the set in this form, however, is only 500 kW.

In the East Works station are four diesel alternator sets of 1,064 kW capacity each, which were commissioned in 1953. The prime movers are of Mirrlees, Bickerton & Day manufacture and comprise JVS 16-cylinder four-stroke exhaust gas turbo-charged units of 1,520 b.h.p. 750 r.p.m. The engines are coupled to salient pole type single pedestal bearing alternators with overhung exciters of Brush manufacture. These machines generate at 3·3 kV and their output is transformed up to 11 kV through solidly coupled auto-transformers of the same make, and switched on to the 11 kV network through remotely operated Reyrolle "C" type switchgear.

Control of each set in this station is at the load control centre, which is in a room at one end of the station about 12ft above the floor level, and is brought to a switch panel containing the necessary instruments and switches for paralleling, synchronizing and remotely closing the o.c.b. Control of the engine load speed mechanism, voltage and power factor rheostat is also effected from the desk and these respective mechanisms are actuated by geared motors suitably protected by limit switches. The exciter field rheostat, field suppression switch and earthing change-over links are housed in small cabinets, one cabinet containing the equipment for two engines.

The Filton station is basically a repeat of the East Works layout, but contains only two Mirrlees/Brush 1,064 kW alternator sets. House supplies and power for emergency operation of the solenoid-operated Reyrolle o.c.b. is derived from a radiator-cooled Paxman-engined 45 kW self-contained alternator set and this machine has sufficient capacity to carry the complete services of the power station and adjacent special services in the event of emergency.

As previously indicated, the load control centre at the East Works is the headquarters of the load control and at a main desk is concentrated all the information covering the loading of the works electrical distribution system. This information indicates to the operator the demands made by various sections of the works, in particular the turbine test department, and enables action to be taken to control the supply so as to maintain a balanced system and a controlled maximum demand. Power factor correction condensers, recently installed at the various substations to maintain economical use of power, are controlled from this desk, as are also the nine diesel alternator sets. The communication system radiating from this centre comprises a network of private telephone lines connecting all h.v. substations, and selected key personnel.

Centrally situated on the desk is a push-button electric telegraph system in communication with the three main generating stations and affording the operational means of starting and stopping generation as required. This is achieved by light signals illuminating a lettered glass panel at each of the power stations, indicating the number of sets to be started and stopped as required. Light signals at the control panel indicate the sets on load. An 18in dial meter tells the operator at a glance the total maximum demand on the system, and the telegraph panel shows the amount of generation at any given moment.

Coal Prices and Supplies

DISMAY at the recent coal price increases at a time when it is of the utmost importance that there should be no further rise in costs is expressed by the Industrial Coal Consumers' Council in its 1953–54 report published last week. The Council feels that this step, taken by a leading indigenous industry, will once again start a vicious spiral of increases in the cost of materials and in wages. It therefore welcomes the news that a committee of eminent industrialists under the chairmanship of Dr. Alexander Fleck has been appointed by the N.C.B. to carry out an independent investigation of the Board's organization.

The Council says it has never been able to understand why, in spite of increasing mechanization, the production of coal shows no margin to meet the increasing demands. The wide disparity between the highest and the lowest weekly output suggests that the extra coal we need is obtainable. The Council notes that ultimately the N.C.B. might put forward proposals to sell industrial coals on a delivered price basis, but does not commit itself to any expression of opinion upon the merits or otherwise of such a basis for industrial coal prices. It considers that it would be imprudent to set stocking targets on a lower scale than recent years, and that it would be too great a risk to rely upon the importation of foreign coal at short notice to prevent a fuel crisis. Because the margin between production and consumption is so small, the Council emphasizes the importance of opencast coal and declares that nothing should be done to limit or hinder the N.C.B.'s prospecting and development of sites. It is alarmed at the likely effect of price increases on some industries and the reaction on the export market for British goods and points out that it recommended that, as a matter of policy, the provision for the estimated increased requirement from all inland sales of £27 million in a full year should be reduced by £5 million. The Minister did not think it right to ask the N.C.B. to reduce this provision below £27 million, but a concession was made that no industrial coal would go up by more than 10s a ton.

The Council recognizes that useful savings are already being achieved; for instance, last year's improvements in the generating efficiency of the British Electricity Authority and carbonizing efficiency of the gas industry alone effected a saving of some 1·25 million tons of coal.

INDUSTRIAL NEWS

Steel Plant Power Station

THE General Electric Co., Ltd., has announced that it has undertaken as a comprehensive contract of over £2 million, the complete power station for the £20 million iron and steel project of Colvilles, Ltd., at Motherwell. This contract includes the power house building and associated civil work; four Babcock & Wilcox gas and oil fired boilers of 125,000 lb/hr each; three 10 MW turbo-alternators with Mirrlees Watson condensing and feed heating plant, feed pumps and auxiliaries; and two steam turbo-driven centrifugal blowers of 11,000 h.p. each, for supplying air to the new furnaces. In addition the work includes two ferro-concrete natural draught towers, each for cooling 1,200,000 gallons of water per hour; two pumps driven by turbines arranged to exhaust steam to process plant; the 11 kV switchgear for control of the alternators and feeders, l.v. switchgear and motors for auxiliaries, and the lighting installation.

Fluorescent Lamp Improvements

The British Thomson-Houston Co., Ltd., has announced a further improvement in its fluorescent lamp range. The "Mazda" 5ft 80 W and 4ft 40 W natural fluorescent lamps now give 16 per cent more light for the same consumption of electricity. Care has been taken to retain the same colour rendering properties of the lamp.

The General Electric Co., Ltd., has also announced increased light output from "Osram" natural fluorescent tubes in the 5ft 80 W and 4ft 40 W sizes. Average light output of the 5ft 80 W tube for the first 5,000 hr of life has been raised from 2,720 to 3,120 lumens, and of the 4ft 40 W size from 1,520 to 1,640 lumens. "Osram" 8ft 125 W tubes are now available in the new warm white colour. The average light output over the first 5,000 hr is 6,875 lumens, or an efficiency of 55 lumens per watt.

South Western Slogan Competition

The prizes in a slogan competition organized by the South Western Electricity Board in connection with the opening of the new Plymouth Electricity Service Centre in George Street were presented to the winners last week by Lady Cynthia Carew Pole, chairman of the S.W. Electricity Consultative Council. In this competition housewives were invited to say briefly why they would like the "Four Foundations of Modern Living" (electric cooker, water heater, refrigerator and washing machine) in their own homes. These appliances, said Lady Carew Pole, had been so called because they provided the foundations of a bright, clean and contented home in which domestic drudgery had been replaced by electrical ease. Installations of electric cookers in Plymouth had doubled, and of electric water heaters nearly trebled, within the last year.

Presenting Mrs. D. Cole, of Plymstock, with an electric cooker as first prize, Lady Carew Pole said she thought entrants had an unbelievably difficult task to sum up, in effect, the many benefits of electricity in a few words. However, Mrs. Cole had epitomized the greatest boon of electricity when she wrote "Electricity switches slaving to labour saving."

Marking of Imported Wire Goods

The Standing Committee appointed by the Board of Trade will hold a public inquiry at the Board of Trade Offices, Horse Guards Avenue, London, S.W.1, on 19th August at 10.15 a.m. and, if necessary, on the following day, to consider whether imported wire goods used for domestic and catering purposes should be required to bear an indication of origin. Communications regarding the inquiry should be addressed to the secretary, Merchandise Marks Committee, Board of Trade, Horse Guards Avenue, London, S.W.1.

Extension of Lyons' Dispute

Last week 100 Covent Garden porters were dismissed for refusing to handle produce for J. Lyons & Co., who are involved in a dispute with the Electrical Trades Union. They were, however, resubmitted for work by the Transport and General Workers Union which operates a "closed shop" at Covent Garden and all but a few were taken back. Later it was reported that a conciliation committee was to consider the dispute at Covent Garden.

At London Airport it was stated that the continuation of the refusal of electricians to service and maintain air and ground catering equipment for food bought from J. Lyons & Co. threatened to interfere with B.O.A.C.'s scheduled services.

Board and Corporation Contracts

Electrical contractors at Eastbourne have complained to the Corporation that the practice of getting the South Eastern Electricity Board to prepare specifications and supervise work done by contractors gives the Board an unfair advantage in tendering for electrical work. On contracts of more than £50 the Board is stated to charge 3 per cent for preparing the specification (1½ per cent for repetitive work) and 2 per cent for supervision (1 per cent for repetitive work). The contractors claim that in some cases this results in the Board's being able to quote with a 5 per cent advantage over private competitors. The Corporation states, however, that the charge for specifications is paid whether the Board does the work or not and that the lowest tender is accepted regardless of the fact that the supervision charge is saved if the Board receives the contract. The alternative would be to employ a consulting electrical engineer which would be more expensive.

Submission of Furnace Plans

When the Birmingham Corporation Bill came before a Select Committee of the House of Commons recently the British Electricity Authority, the Federation of British Industries and the Birmingham Chamber of Commerce opposed a provision requiring the submission of plans of new furnaces. The object of the clause, it was stated, was to give the Corporation an opportunity of making suggestions to ensure that new furnaces would not emit smoke and grit. After arguments had been heard the chairman announced the Committee's decision that the clause should not stand as part of the Bill.

Ministry of Materials

A draft Order in Council dissolving the Ministry of Materials and transferring its remaining functions to the Board of Trade from 16th August, was laid before both Houses of Parliament on 15th July. Sir Winston Churchill in making the announcement said that by the end of the current financial year the great bulk of the stocks which the Ministry had held would have been disposed of at fair market prices.

Plant for Penang

Negotiations have been completed by the English Electric Co., Ltd., with Preece, Cardew & Rider, consulting engineers, acting on behalf of the Municipal Council of Georgetown, Penang, for the supply of two 10,000 kW, 11 kV turbo-alternator sets, designed to operate at 400 p.s.i., 800 deg F, with condensers and feed heating equipment. These sets are for the new power station, to be constructed on Penang Island, which will replace the old power station at Prai.

Institute of Metals

The programme of the annual autumn meeting of the Institute of Metals, which will be held in Switzerland from 6th to 14th September, has now been issued. The meeting will open in Zurich and on 11th September members and their ladies will leave Zurich for Montreux for the remainder of the meeting. In addition to a number of technical discussions, visits will be paid to several engineering works, whilst ample opportunities for sight-seeing will be provided.

Exhibition of power factor correction equipment held recently in Sheffield by the Sheffield Sub-Area of the Yorkshire Electricity Board

Power Factor Improvement

The new standard industrial tariffs which are to be introduced by the Yorkshire Electricity Board with effect from 1st October next will require consumers to make more efficient use of electricity by improving their power factor if they are to avoid paying more for their electricity than they need. To enable industrialists to discuss their problems and to see the power factor correction equipment available the No. 3 (Sheffield) Sub-Area of the Board recently held an exhibition at the City Hall, Sheffield. Ten manufacturers of power factor correction equipment co-operated and invitations were sent out to the industrial consumers. Some 420 representatives of 200 local concerns availed themselves of this opportunity to discuss with the Board's representatives and the manufacturers their own particular problems. The accompanying picture shows the stands in the Mezzanine Hall of the City Hall.

Canadian Plant Contract

In our last issue we reported that the English Electric Co., Ltd., had received a contract from the Nova Scotia Light & Power Co., for generating plant. We have now received further details. The plant will consist of a 45,000 kW, 3,600 r.p.m. steam turbo-alternator set, complete with feed heating and condensing plant, for installation at the Water Street power station, Halifax, Nova Scotia. The turbine is designed to operate with steam at 900 p.s.i.g., 900 deg F, at the turbine stop valve and for five stage feed heating with a vacuum of 28½in at m.c.r. The alternator is of the hydrogen-cooled type for generation at 13·2 kV, three-phase, 60 c/s. The condensing plant is of the cleanable twin shell type and the five stage feed heating scheme will comprise three low-pressure and two high-pressure feed water heaters.

Trailer Power Set for Cyprus

A. C. Morrison (Engineers), Ltd., has recently shipped a new trailer power set to the Cyprus Water Supply and Irrigation Department, Nicosia. It will be used for the supply of power to submersible electric pumps for bore-hole test pumping. Because of the arduous conditions under which it will operate, special care has been exercised in both design and manufacture to enable it to travel over very rough roads and tracks and to run for 24 hours a day over long periods at high altitudes and between temperatures of 20 and 150 deg F.

The plant comprises a 26 kW (32·5 kVA at 0·8 power factor) diesel alternator set, 230/400 V, 3-phase, 50 c/s, with control panel, all of which is housed in a 4-wheel trailer of special design. The power unit consists of a McLaren "M2" two-cylinder diesel engine with water and oil cooled radiator, fitted with a heavy electric flywheel and having a 12-hour rating of 44 b.h.p. at 1,000 r.p.m. The engine is flexibly coupled to a rotating field type alternator with flange mounted exciter and separate matching automatic voltage regulator. Electric starting is by push-button and the equipment includes 24 V starter batteries, C.A.V. motor and dynamo.

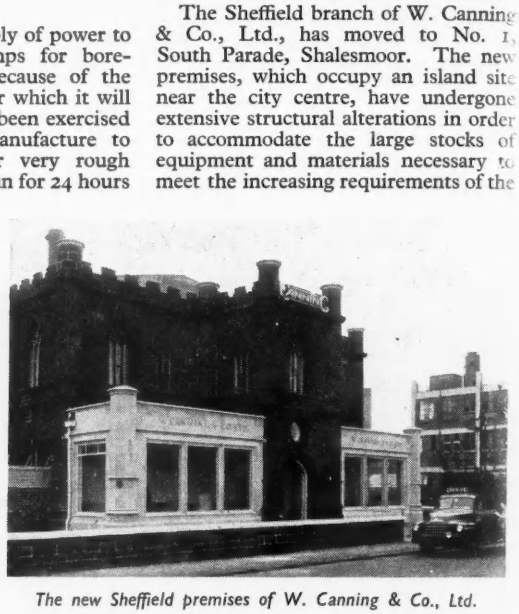
Training of Supervisors

The Report of the Ministry of Labour Committee of Inquiry on the Training of Supervisors (H.M. Stationery Office, 2s) makes it clear that while much thought has been given to this problem and valuable work done in many sectors of industry "British industry as a whole is still a long way from full realization of the importance of the subject." It is estimated that there are about 300,000 supervisors in industry throughout the country and that well over 10,000 new supervisors will be needed each year. After giving a factual survey of existing facilities, the Committee comments on various aspects of the subject and finally sets out its conclusions.

The Committee considers that a very great deal more needs to be done both within industry and outside it to provide more and better facilities for training and to ensure that they are used to the best advantage. Because of the urgency of the matter it wants these developments speeded up. The main responsibility for the training of supervisors must be accepted by the management of an undertaking. There is need both for more training related to the day-to-day work of the supervisor of a factory, and for an examination by industry of the status of the supervisor and recognition of his importance as a member of the management team.

Canning's New Sheffield Premises

The Sheffield branch of W. Canning & Co., Ltd., has moved to No. 1, South Parade, Shalesmoor. The new premises, which occupy an island site near the city centre, have undergone extensive structural alterations in order to accommodate the large stocks of equipment and materials necessary to meet the increasing requirements of the plating trade in the North. In addition to offices, warehouses and loading bay, the building includes a retail shop and showroom. An analytical laboratory will be available in due course.



The new Sheffield premises of W. Canning & Co., Ltd.

Railway Traffic Control

Two contracts have recently been awarded to the Westinghouse Brake & Signal Co., Ltd., for the supply of centralized traffic control apparatus for Rhodesia and New Zealand.

The Rhodesian installation will cover some 85 miles of single track having fifteen fully signalled crossing stations, and will be controlled by Westinghouse 2-wire, time-coded, centralized traffic control from a station at Sawmills situated about 60 miles from Bulawayo.

The Westinghouse Co. is also supplying centralized traffic control equipment of a similar type to the above to the New Zealand Railways for the Upper Hutt–Featherstown section of line. In this case the section concerned only being some ten miles in length and having three crossing stations, no carrier control is needed and the control

will be of the direct 2-wire coded type. The wayside equipment is being supplied by the New Zealand authorities.

Salesmanship Training

A 14-page brochure issued by the British Electrical Development Association entitled " Salesmanship Training," gives full details of the Salesmanship Course conducted by the Association, including conditions of award of the B.D.A. Domestic Electricity Salesmanship Certificate and Diploma and the B.D.A. Sales Engineers' Diploma. The course normally starts on 1st October each year, and applications for enrolment have to be submitted not later than 1st September.

Works Visit

About twenty-five members of the London Branch of the Association of Mining Electrical and Mechanical Engineers visited the switchgear works at Willesden of the British Thomson-Houston Co., Ltd., on 10th July. They were welcomed by Mr. P. E. Gaze, manager of switchgear sales, and were then given a review of B.T.H. electrical mining equipment in an informal talk with lantern slides by Mr. D. Creeth of the Mining Department at Rugby Works. Dr. J. R. Mortlock and Mr. K. M. Jones of the Power System Engineering Department gave demonstrations with models of transients on electrical networks. After the visitors had inspected the A.E.I. network analyser they toured the factory with senior officials of the sales and engineering staffs and saw switchgear ranging from l.v. to the latest 275 kV oil circuit breakers now being manufactured for the British Electricity Authority. The tour finished with a small display of fluorescent lighting and other mining fittings in the high voltage test laboratory, and after a demonstration of impulse testing introduced by Mr. J. H. Marlow, the visitors assembled for tea. Mr. Brian Morgans, president of the London Branch, proposed a vote of thanks to which Mr. H. E. Cox, manager of the Willesden Works, replied.

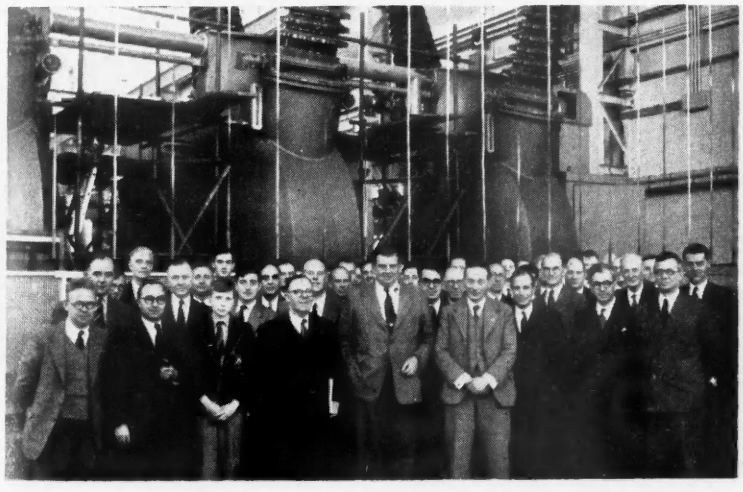
Westinghouse Convention

A convention of the Rectifier Division of Westinghouse Brake and Signal Co., Ltd., was held on the 6th and 7th July at the Francis Hotel at Bath. Some sixty members of the company's staff took part, representing sales, engineering, research and production, including sales staff from offices in London, Birmingham, Manchester, Newcastle-on-Tyne, Glasgow and elsewhere. The convention started with dinner which was followed by discussions of many current problems concerning the continued increase in rectifier sales of " Westalite " rectifier equipments. The following day the discussions continued and the party later moved to the works at Chippenham to examine new designs of rectifier equipment under development.

Britain and the U.S. Market

Speaking at Manchester last week Mr. W. J. Scott Laing, deputy consul general (commercial) in New York, said that the biggest obstacle to British firms obtaining contracts for heavy electrical plant in America was not U.K. prices but the " Buy American " Act. Experience had shown that British firms could often offer better quotations than American firms for heavy electrical plant, Mr. Laing told members of the United States Section of Manchester Chamber of Commerce. At the same time, the machinery was of as high a quality and perhaps better than the Americans could produce themselves. The difficulty lay in the special considerations under the " Buy American " Act, but it was hoped that the position would improve in the future. British firms were certainly out to get big engineering contracts in America if they could.

Members of the London Branch of the Association of Mining Electrical and Mechanical Engineers at the Willesden Switchgear Works of the British Thomson-Houston Co., Ltd.



Trade Announcements

Air Control Installations, Ltd., is opening a branch office in the Newcastle-on-Tyne area, and has appointed Mr. N. J. Shergold as branch manager. Inquiries should for the present be addressed to Mr. Shergold at 76, Holywell Avenue, Whitley Bay, Northumberland (telephone: Whitley Bay 23046).

Almag Engineering Co., Ltd., is now in liquidation and its goodwill and patents have been acquired by **Tempo Aluminium, Ltd.,** 46, Pembridge Road, London, W.11 (telephone: Bayswater 1146/7/8).

George Kent, Ltd., and **Foxboro-Yoxall, Ltd.,** announce that they have made arrangements for mutual marketing of the Foxboro d/p cell and the Kent oxygen analyser in the United Kingdom. Foxboro selling of the Kent oxygen analyser may later be extended to the United States.

The Non-Ferrous Die Casting Co., Ltd., has recently formed an associate company for the production of hot stampings in brass, bronze and aluminium. The name of this company is Brass Pressings (London), Ltd., and presses, plant and equipment have now been installed in a part of the Cricklewood works.

Linealux, Ltd., has appointed two further area representatives. Mr. H. W. Niven, 1, Terrace Place, Newcastle-upon-Tyne, 2 (telephone: Newcastle 26804) will cover Northumberland, Cumberland, Westmorland, Durham, including Middlesbrough; while Mr. S. A. Woods, Faulkner's Electrical Supplies, Ltd., 11, Albert Square, Manchester, 2 (telephone: Blackfriars 2459) will cover Lancashire, Cheshire and North Wales.

Teddington Industrial Equipment, Ltd., has opened a Scottish area office at 134, St. Vincent Street, Glasgow (telephone: Glasgow Central 7935), under the management of Mr. R. S. Bruce. A northern district office has also been opened at 31, Quay Street, Manchester.

The head office of **Klaxon, Ltd.,** is now 49, Upper Brook Street, London, W.1 (telephone: Mayfair 9020).

Catalogues and Lists

Brentford Transformers, Ltd., Kidbrooke Park Road, London, S.E.3.—A set of six leaflets dealing with voltage regulation, brilliancy control of airfield lighting, street pillar distribution regulator, tail-end booster, rural distribution transformers and electric furnace control.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Technical publication dealing with the operation of the " S.E.I." electromagnetic transducer system.

Henry Wiggin & Co., Ltd., Wiggin Street, Birmingham, 16.—" Wiggin Nickel Alloys—26 "—the company's technical journal containing details of the Belgian " S.A.M." washing machine.

Dewhurst & Partner, Ltd., Inverness Works, Hounslow.—Illustrated folder featuring " Dupar " severe duty control equipment with magnetically operated contactors.

Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick, London, W.4.—Technical leaflet giving details of the recently developed 10,000 V mains operated " Megger " insulation tester (281).

Financial Section

STOCKS and SHARES

IT has been the turn of gilt-edged stocks to make most of the running in Stock Exchange markets. British Electricity stocks are as much as a point or so up, in reflection of the general advance of British Government securities which followed the success of the Treasury's latest funding operation. In the industrial markets, profit-taking contended with new investment, producing some irregularity in the price lists. Shares of the big electrical equipment and engineering groups again received support, and G.E.C. ordinary were particularly prominent in rising from 44s 3d to 47s 6d, in advance of the final dividend declaration expected yesterday (Thursday); a previous influence was the news of the company's £2 million contract in connection with power for Colvilles' new steel project.

Calling a Halt

Nobody in the Stock Exchange appeared to be greatly surprised when, on Monday in this week, prices were disposed to turn downward. The reaction was of little consequence, and the falls in the gilt-edged market, where previously the rises had been most marked, were of trifling extent. The slight heaviness in the Consol market had some effect upon other parts of the House, and industrials gave way in the absence of fresh support. Stock Exchange dealings are now taking place for settlement on 17th August, this being what is known as a 21-day account, and, by tradition, the autumn is a quiet time for stocks and shares, with the corollary of prices tending to sag on balance.

Price Changes

Heavy engineering shares have been in favour, as witness the improvements during the past week or two of three shillings in Babcocks, W. H. Allen, Clarke Chapman, and Mather & Platt. Thornycroft gained 5s, at 47s 6d. Enfields, Siemens and T.C. & M. were to the fore in the cable group. Southern Areas added 3s 9d and Plessey 4s to previous striking improvements. Others noticeably in favour included B.E.T., English Electric, Reyrolle, Lancashire Dynamo, and Laurence Scott. Oriental Telephones at 89s 3d have put on 8s 6d.

Hire-Purchase

Positive reactions occurred in some sections of the electrical markets to the Government decision to lift restrictions on hire-purchase in a range of goods including radio and TV sets, refrigerators and vacuum cleaners. Shares of the retailers and distributors of such equipment were singled out for attention, a notable result being the rise of 3s to 25s 6d in the price of J. & F. Stone 5s shares. Presumably the anticipation of benefits to manufacturers had something at least to do with the week's improvements in such shares as

Week's Price Changes

Company or Board	Nom. Value	Middle price 19th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1954 Highest	1954 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	95	+1⅛	3	3	3 3 2	95	88⅝
Brit. Elec. 1974/77	100	94	+1	3	3	3 4 0	94	87¼
Brit. Elec. 1976/79	100	98⅛	+⅛	3⅛	3⅛	3 10 9	99	93 9/16
Brit. Elec. 1974/79	100	108⅛	+1	4¼	4¼	3 18 4	108⅛	103 5/16
Overseas Electric Supply								
Calcutta Elec.	£1	21/3		6†	6†	5 13 0†	21/6	18/7
East African Power	£1	20/6	+6d	7	7	6 16 7	23/4	19/6
Nigerian Elec.	£1	24/6		10	10	8 3 4	25/-	23/6
Palestine Elec. "A"	£1	20/6		Nil	Nil	Nil	20/6	16/-
Perak Hydro-Elec.	£1	15/-	+1/-	Nil	6	8 0 0	15/6	13/9
Equipment and Manufacturing								
Aberdare Cables	5/-	10/6	+3d	25	12½*	5 19 0	10/6	8/1
Aerialite	1/-	11/3		88⅛	88⅛	7 17 0	12/3	10/9
Allen, W. H.	£1	73/3	+3/3	15	20	5 9 3	73/3	50/-
Aron Elec. Ord.	£1	45/-	−5/-	20	15	6 13 4	50/-	43/-
Assoc. Elec. Ord.	£1	57/6		20	11¼*	3 17 0	58/-	41/6
Automatic Tel. & El.	£1	70/-	−1/3	15	15	—	71/3	57/3
Babcock & Wilcox	£1	61/-	+3/-	18	12*	3 18 9	61/-	47/3
Baldwin, H. J.	2/-	4/6		20	20	8 18 0	5/6	3/9
Bakelite	10/-	26/3		12½	12½	4 15 3	27/6	23/6
British Aluminium	£1	38/-	+6d	12	10	5 5 3	40/-	34/6
B.I. Callender's	£1	45/9	+6d	10	10	4 7 6	45/9	37/9
B.I. Callender's 6% Pref.	£1	26/-		6	6	4 12 3	26/-	24/3
British Thermostat	5/-	23/9		35	27½*	—	23/9	12/-
British Vac. Cleaner	5/-	14/-	+1/-	25	25	8 18 6	14/6	11/6
Brook Motors	10/-	42/6		20	20*	4 14 3	42/6	33/3
Brush Ord.	5/-	6/9		4	6	4 9 0	7/-	3/6
Bulgin, A. F.	1/-	3/3		30	30	9 4 6	3/7	3/2
Burco	5/-	15/9		35	35	5 11 0*	15/9	12/1
Chloride El. Storage	£1	68/-	+1/9	20	12½*	3 13 6	68/-	46/6
Clarke Chapman	£1	58/9	+3/3	17½	20	—	58/9	47/6
Cole, E. K.	5/-	35/9	+3/3	25	27½	3 17 0	35/-	22/6
Cossor, A. C.	5/-	9/-	+6d	10	10	5 11 0	9/-	7/-
Crabtree	10/-	28/9		17½	17½	6 1 9	29/6	23/9
Crompton Parkinson Ord.	5/-	18/3	+3d	11¼	20	5 9 7	18/3	14/-
De La Rue	5/-	16/3	−1/-	Nil	20	6 3 0	17/3	12/3
Decca	4/-	41/6		150	35*	—	41/6	32/-
Desoutter	5/-	18/9		18	20	5 6 8	18/9	16/1
Dewhurst	2/-	6/-		19	19	6 6 9	6/3	5/1
Dictograph Tel.	2/-	6/-		20	20*	6 13 4	6/3	5/2
Dubilier Condenser	1/-	5/6		28	25*	4 11 0	6/-	4/1
E.M.I.	10/-	17/9		12	8	4 10 2	17/9	11/3
Electrical Components	5/-	13/3	+1/3	20	20	7 11 0	13/3	10/9
Elec. Construction	£1	60/-		15	15	5 0 0	61/3	53/-
Enfield Cable Ord.	£1	25/-	+2/6	5	Nil	Nil	25/-	16/6
English Electric	£1	48/9	+1/3	15	10*	4 2 0	48/9	38/-
English Electric 3¾% Pref.	£1	16/6		3¾	3¾	4 11 0	16/6	15/3
Ericsson Tel.	5/-	26/6	+9d	22†	25†	2 7 2†*	26/6	22/9
Ever Ready	5/-	25/-	+1/-	35	40	—	25/-	17/9
Falk Stadelmann	£1	38/6	+6d	15	15	7 16 0	41/-	36/6
G.E.C. Ord.	£1	47/6	+3/3	22½	11¼*	4 14 9	47/6	37/6
G.E.C. 6½% Pref.	£1	27/-		6½	6½	4 16 3	27/3	26/6
General Cables	5/-	16/9	+6d	30	30	8 19 0	16/10	16/3
Greenwood & Batley	£1	48/9		17½	17½	7 3 6	48/9	40/3
Hackbridge Cable	5/-	15/3	+3d	20	20	6 11 6	15/3	11/3
Hackbridge & Hewittic	5/-	23/3		20	25	5 7 6	23/3	16/10
Hall Tel. Acc.	10/-	11/-		10	10	9 1 9	11/11	10/6
Heatrae	2/-	5/-	+3d	12½	12½	5 0 0	5/-	4/-
Henley's	10/-	19/6		10½	10½	5 7 9	19/6	15/6
Holophane	5/-	15/3		20	20	6 11 2	15/3	13/1

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

Hoover, Morphy-Richards, Vactric and Parnall. The radio group, already in good form, went further ahead on the strength of this latest development. Broadcast Relay new shares were 15s premium at the opening last Monday, but subsequently they gave way to 13s premium.

Pye Issue

Pye, Ltd., fixed the price of their new issue of 5s "A" deferred shares at 20s. Letters giving existing holders a provisional allotment of one of the new for every five shares held went out over last week-end. Dealings have been taking place in the new at a premium of 7s, leaving the old shares quoted at 28s ex-rights. At the start of this month, Pye declared an increase in the deferred dividend to 20 per cent, so that, assuming the maintenance of that rate on the now increased capital, the prospective yield on the shares is £3 11s. An important feature of the full accounts is the disclosure that the now defunct excess profits levy cost the company last year half as much again as the net deferred dividend payments.

in Electrical Investments

Company or Board	Nom. Value	Middle price 19th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1954 Highest	1954 Lowest
Equipment and Manufacturing—continued.								
Hoover	5/-	40/9	+3/-	25	45	5 10 6	40/9	26/3
G.I.	£1	35/-xb		13	15	—	74/3	52/9
Itl. Combustion	5/-	24/-		15	20	4 3 4	24/-	14/6
Johnson & Phillips	£1	48/-		15	15	6 5 0	52/3	47/6
Lancashire Dynamo	£1	57/6	+1/3	12½	14	4 17 6	57/6	43/-
Laurence, Scott	5/-	25/-	+1/3	15	20	4 0 0	25/-	14/-
Lister, R. A.	£1	43/6		9	12	5 10 4	43/6	31/9
London Elec. Wire	£1	47/3		15	10°	4 4 9	47/3	38/-
Lucas, J.	£1	68/9		9⅛	10⅛	3 3 0	68/9	50/3
Marryat & Scott	2/-	7/-		22½	25	7 2 9	7/-	5/11
Mather & Platt	£1	78/-	+2/6	12½	15	3 17 0	78/-	53/1
Metal Industries	£1	32/6	+6d	12	9	5 10 9	42/3	29/6
Midland Elec. Mfg.	£1	67/6		15	15	4 9 0	67/6	63/-
Morphy-Richards	4/-	20/-	+1/3	40	40	—	20/-	11/4
Murex	£1	54/6	−2/6	15	15	5 10 1	57/-	50/-
Newman Ind.	2/-	2/4½		10	10	8 8 5	2/6	2/-
Oldham & Son	1/-	3/-		35	17½°	5 16 8	3/4	2/5
Parnall (Yate)	5/-	7/-	+6d	6	8	5 14 3	7/-	4/3
Parsons, C. A.	£1	55/-		12½	7½°	2 14 6	56/3	38/1
Plessey	10/-	56/-	+4/-	25	30	—	56/-	37/10
Pye Deferred	5/-	28/-		20	20°	3 9 7	28/9	15/7
Revo	10/-	17/3	−6d	27½	9°	5 4 3	20/3	16/7
Reyrolle	£1	90/-	+1/3	12½	13⅓	3 1 0	90/-	66/-
Rheostatic	4/-	12/6		19	20	6 8 0	12/9	11/-
Richardsons Westgarth	5/-	11/3		12	15	—	11/9	6/6
Scottish Cables	4/-	17/6	+3d	20	27½	6 5 9	17/6	12/11
Siemens Ord.	£1	39/6	+2/-	10	10	5 1 3	43/9	33/9
Smith (England), S.	4/-	11/6	+6d	12½	15	—	11/6	7/8
Southern Areas	£1	25/-	+3/9	6	7½	6 0 0	25/-	17/6
Strand Elec.	5/-	8/9		17½	17½	10 0 0	9/3	8/3
Sturtevant	5/-	40/-	+1/6	18·1†	18·9*†	2 7 3†	40/-	29/-
Sun Elec.	£1	32/6		15	15	9 4 8	32/6	27/6
Switchgear & Cowans	5/-	12/9		22½	10	3 18 6	13/7	9/9
Taylor Tunnicliff	5/-	11/-		25	12½°	5 13 9	12/4	10/7
T.C.C.	10/-	32/6		20	30°	—	32/6	21/3
T.C. & M.	£1	33/9	+1/3	10	8½°	5 0 9	34/6	30/3
Telephone Mfg.	5/-	9/-		10	10	5 14 3	9/-	7/6
Thorn Elec.	5/-	21/6		12½	12½	2 18 2	21/6	13/3
Thornycroft	£1	47/6	+5/-	15	15	6 6 3	47/6	32/4
Tube Investments...	£1	66/3		15°	15	4 10 6	68/9	60/3
Vactric	5/-	16/9	+2/3	Nil	10	2 19 9	17/6	7/6
Veritys	5/-	6/9		10	12½	9 5 3	8/3	5/-
Walsall Conduits	4/-	52/6		70	70	5 6 8	52/6	44/-
Ward & Goldstone	5/-	63/3		45	50	3 19 0	63/3	41/3
Watford	2/-	6/3		25	22½°	—	6/3	4/7
Westinghouse Brake	£1	72/6	+2/-	14	15	4 2 9	72/6	60/9
West, Allen	5/-	15/9	+6d	15	17½	5 11 0	15/9	12/7
Wolf Electric	5/-	13/9		15	17½	6 7 3	13/10	11/-
Trusts, Transport and Communications								
Anglo-Am. Tel.:								
A Ord.	100	82½		—	6	7 5 6	89½	80
Ord.	100	52½		—	3¾	7 2 10	55½	52
Anglo-Portuguese	£1	23/-	−3d	8	8	6 19 2	24/-	21/-
Brit. Elec. Traction:								
Def. Ord.	5/-	59/-	+1/-	35	50	4 4 9	59/-	39/1
Cable & Wireless:								
Ord.	£1	37/6	−6d	8	9	4 5 4	40/6	26/2
4% Loan	100	98½		4	4½	4 1 3	98½	95½
Calcutta Trams	£1	19/-		6†	2½††	—	19/3	17/1
Cape Elec. Trams	£1	15/-		5½	5½	7 6 8	15/3	12/4
Marconi Marine	£1	33/9		10	10	5 18 6	33/9	27/6
Oriental Tel. Ord.	£1	89/3	+8/6	16	16	—	90/-	82/6
Telephone Props.	£1	5	+¼	8	8	—	5 1/16	4¼
Telephone Rentals	5/-	10/-	+3d	10	10°	—	10/3	9/-

Company News

E. K. Cole stockholders duly passed at last week's meeting the proposals for an increase, by 2·2 million ordinary shares, in the authorized capital. They now await the offer of a substantial proportion of them on favourable terms. Consent of the Capital Issues Committee has to be obtained. New money is needed, the chairman said, to provide additional working capital for the general purposes of the business, which has been continually expanding since the war. The price of the 5s shares has meanwhile risen another 3s 3d to 35s 9d. Revo Electric 10s shares were quoted at 17s 3d after the issue of the full report, which anticipates a measure of recovery in profits for the current year. Dealings in the new Lucas shares started last Tuesday.

Electrical Components Results

Electrical Components, Ltd., reports an increase of almost a third in the net profit for the latest year, despite a much larger tax charge, and is keeping the ordinary dividend to the rate of 20 per cent paid regularly for a number of years past. The 5s shares were marked up to 13s 3d, at which the yield works out at just over 7½ per cent on a dividend covered nearly three times by the net surplus of earnings. In advance of the full report, the market took the good figures to be a reflection of more active trading conditions in the field of domestic appliances, radio sets and kindred equipment.

Bagdad Power

A speculative position in the £1 shares of Bagdad Light & Power was apparently upset by last week's statement from the company. In the two days following this, the quotation fell from 65s to 53s 9d before a rally to 58s 9d. The announcement corrects a report to the effect that the Iraq Government must exercise its take-over option by the last day of this year or wait another five years for the next opportunity. In fact, the company points out, the Government would have had to give notice of early acquisition by the end of last year, and did not do so. Apparently there is still no certainty about the Government's intentions.

REPORTS and DIVIDENDS

E. K. Cole, Ltd.—Presiding at the annual meeting held on 15th July, Mr. E. K. Cole (chairman and managing director) said that the turnover for the year under review achieved a new high record. Referring to the various divisions of the company, Mr. Cole said that the radio industry experienced good trading conditions during the year. The public demand for the company's television and radio increased, and the advent of the new f.m. and v.h.f. transmissions to cover a substantial part of the country in 1955 should also help in maintaining the level of sales of sound receivers. They were ready with models and designs to meet the situation which would arise from the provision of a second television programme.

Last year he referred to the formation of a separate company to deal with the development and sale of nucleonic and electronic equipment. During the year the production and sales for Government services and commercial use continued to expand and an important volume of export business was achieved. Trading conditions in the plastics industry continued to improve and operations of that division showed a satisfactory result. The heating division increased its turnover, although the overall trading result was not yet satisfactory. There was an increasing interest in electric space heating for domestic and industrial use, and the re-designed heaters launched last year were well received. Despite restrictions by overseas governments exports were maintained at a substantial figure. During the year a further important order for television sets for Canada was received and these were now being produced.

Ward & Goldstone, Ltd.—In his statement accompanying the report and accounts, Mr. S. Goldstone (chairman and managing director) says that production as well as sales exceeded all previous records during the year under review, though profit margins have fallen and are still falling. Conditions in the home trade improved over the past year. The export problem is serious and urgent. While they succeeded in increasing the volume of sales over the previous year, many of the larger transactions were executed virtually without profit. Not only are British exporters impeded by import restrictions, but foreign governments are supplying artificial aids to their manufacturers in the way of taxation concessions and other forms of subsidy.

Giving particulars of the proposed increase in capital, Mr. Goldstone says that the approval of the Capital Issues Committee has been obtained to an increase in the capital by the issue of 691,877 ordinary shares which will be credited as fully paid to existing stockholders in the proportion of one new share for each ordinary unit held. The new shares will not participate in any dividend in respect of the year to 31st March last, but will rank *pari passu* in all other respects with the existing ordinary stock. The proposed capitalization of a portion of the reserves should not imply any greater distribution of profits in the future.

Reliance-Clifton Cables & Industrial Products, Ltd.—In the course of his speech at the annual meeting held on 15th July, Sir Robert Renwick, Bt. (chairman), said that since the company acquired the cable making business in 1946 each year had shown an increase in profits and in 1952, with all materials freely available, profits before tax soared to double the level of the earlier years. In his review last year the acting chairman emphasized that there was no possibility of this exceptional figure being attained for the year now under review. He referred to the announcements by the Ministry of Supply in April, 1953, of a substantial reduction in the price of copper and of decontrol in the following August, and that this had resulted in a general curtailment of orders to cable makers. Decontrol did not result in the substantial fall in the price of copper which had been generally anticipated. There was a gradual improvement from the autumn in the volume of business, but the pattern had changed. Short term orders and a decrease in profit margins reflected the change in conditions.

It was apparent that in the section of the industry in which the company operated, there was to be at least a pause in the rising tide of prosperity which had been enjoyed for many years and which reached a peak in 1951–52. On the other hand, there was no question but that the demand for electric cables for all purposes would continue to increase. For the first six months of the present year they had been standing up well to the difficult trading conditions, and if there was no further deterioration during the remainder of the year, results for 1954 should not be unsatisfactory. The reserves of the company were now considered to be adequate to deal with proposed capital expenditure during the next few years and the board would have this in mind in considering future dividend recommendations.

Simon-Carves, Ltd. — The accounts for 1953 show a trading profit, after adjustment of special provision for retention balances on completed contracts, of £616,112, as compared with £760,695 for 1952, to which is added other income of £19,165. After meeting all charges, including £321,903 for taxation, the net profit is £163,784 (against £279,206). It is proposed to pay a final dividend of 7½ per cent, making 20 per cent for the year (unchanged). The balance carried forward is £331,648 (against £279,763 brought in after capitalizing £43,385).

George Kent, Ltd.—The net profit of the parent company for the year to 27th March last, after deducting taxation of £156,533, is £149,414 (against £214,017 for 1952–53). It is proposed to pay a final dividend of 9½ per cent, making 12½ per cent for the year (unchanged) on capital increased by a "rights" issue of 366,506 ordinary 10s shares.

Pye, Ltd.—Further particulars are now announced regarding the issue of "A" deferred ordinary shares, reference to which was made in our issue of 2nd July. The price of the new 5s shares will be 20s and holders of deferred ordinary and "A" deferred ordinary will be offered a total of 761,529 shares on the basis of one for every five held.

Electrical Components, Ltd., reports group trading profits for the year ended 31st March last of £138,943, as compared with £110,008 for 1952–53. Taxation requires £80,309, and it is proposed to pay a final ordinary dividend of 12½ per cent, maintaining the distribution for the year at 20 per cent. The balance retained as reserves is £39,289 (against £28,541).

Hoover, Ltd., has declared an interim dividend of 10 per cent (unchanged).

Bankruptcies

G. L. Searle, 186, Colne Road, Twickenham, Middlesex, lately residing and carrying on business as an electrical engineer at 309, Portobello Road, London, W.10.—Receiving order made 9th July on debtor's own petition. First meeting 29th July and public examination 5th October, both at Bankruptcy Buildings, Carey Street, London, W.C.2.

E. T. M. Marshall, residing at 59, Denham Road, Burgess Hill, Sussex, radio engineer, formerly carrying on business at High Street, Hurstpierpoint, Sussex, under the style of G.E.M. Radio Electric as a radio and electrical dealer.—First meeting to-day (Friday). Public examination 10th September at the Court House, Church Street, Brighton.

H. F. Thorrington, Eydon, Northants, electrical contractor.—Last day for receiving proofs for dividend 31st July. Trustee, Mr. W. J. W. Hill, 58–61, York Terrace, Regent's Park, London, N.W.1, Official Receiver.

E. S. Mellor, 15, Cole Street, Scunthorpe, Lincs, electrical engineer.—Last day for receiving proofs for dividend 31st July. Trustee, Mr. H. S. Bloomer, 8, Flottergate, Great Grimsby, Official Receiver.

F. E. V. Hooper, 277, South Road, Walkley, Sheffield, also carrying on business as "Hoopers Service Station," Walkley Road, Walkley, Sheffield, electrical engineer.—Further supplemental dividend of 7s 2d in the £, payable at the Official Receiver's office, 55, Queen Street, Sheffield, 1.

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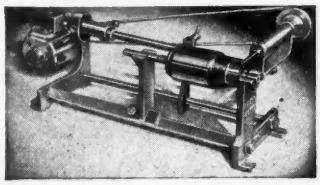
MICA UNDERCUTTERS

AERO-AUTO



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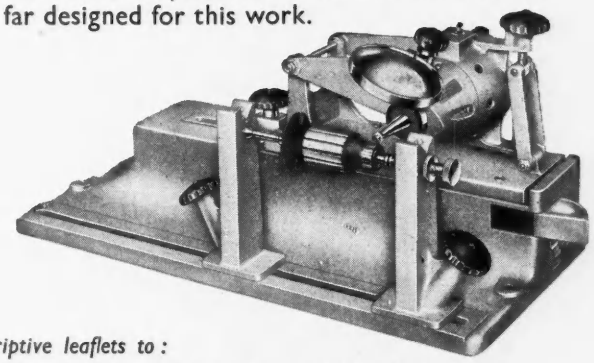

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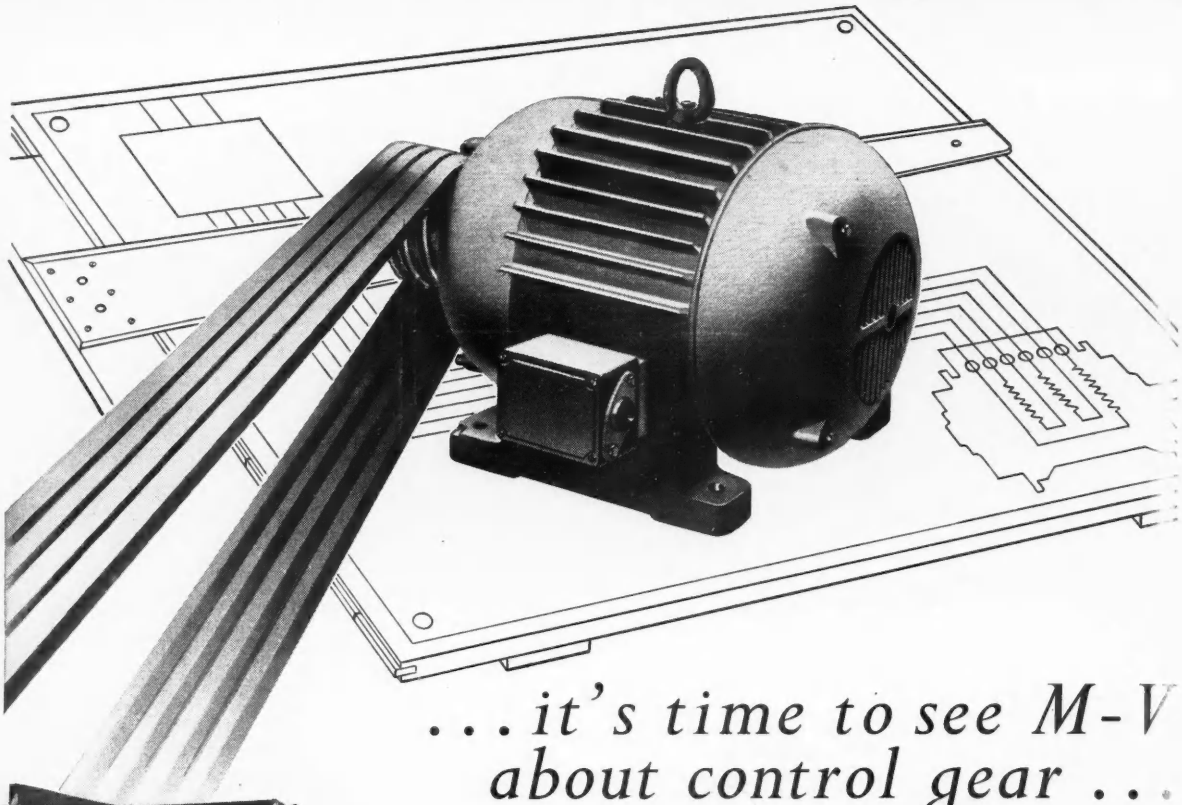

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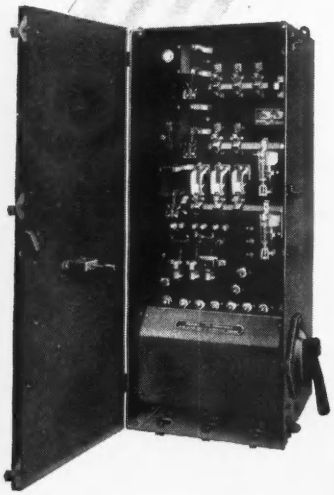

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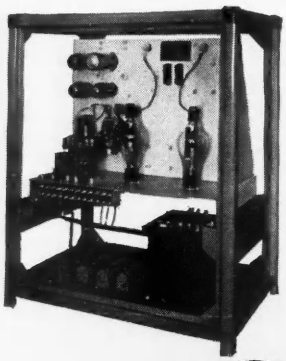

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Six Months' Output

DURING the first six months of this year the British Electricity Authority and the North of Scotland Hydro-Electric Board generated 36,698 million kWh, an increase of 3,545 million kWh (10·7 per cent) compared with the corresponding period of 1953 (see Table I). At the end of June the total installed plant capacity was 29,520 MW, representing an addition of 451 MW since the beginning of the year. Last month, new plant installed in the B.E.A.'s stations included a 405,000 lb/hr Babcock & Wilcox boiler at Barking "C," a 360,000 lb/hr unit of the same make at Tilbury and one of 320,000 lb/hr at Brighton; a 52,500 kW Metropolitan-Vickers set and 320,000 lb/hr Clarke Chapman boiler at Brunswick Wharf; a 52,500 kW M.V. set at Deptford East; a 30,000 kW Richardsons Westgarth set and 240,000 lb/hr Mitchell boiler at Acton Lane (Willesden); a 300,000 lb/hr Yarrow boiler at Bold "A"; and a 60,000 kW Parsons set and 550,000 lb/hr Stirling boiler at Keadby.

Table II analyses the sales by the Area Boards in June. The national figures show an increase over June, 1953, of 9·7 per cent but when corrected for weather conditions which were much colder than a year earlier and for the fewer working days the increase is 8·8 per cent.

TABLE I.—ELECTRICITY GENERATED AND PLANT INSTALLED*

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total†		
British Electricity Authority ...	2,689	76	7·5	4,961	29	4,996	4,682	18,954
N. of Scotland H.E.B.	23	1	0·9	35	55	94	92	566
Total for June, 1954	2,712	77	8·4	4,996	84	5,090	4,774	19,520
Corres. total for June, 1953 ...	2,544	66	5·0	4,552	62	4,626	4,343	18,036
Increase or decrease, per cent ...	+6·6	+16·7	+68·0	+9·8	+35·5	+10·0	+9·9	+8·2
Total to date (6 months), 1954 ...	19,594	589	73·9	35,923	701	36,698	34,518	
Total for corres. 6 months of 1953	18,153	474	40·5	32,551	520	33,155	31,207	
Increase or decrease, per cent ...	+7·9	+24·3	+82·5	+10·4	+34·8	+10·7	+10·6	

* Comprising all generating stations controlled by the British Electricity Authority and the North of Scotland Hydro-Electric Board.

† The total figure includes 6 million kWh generated by oil engines, and 4 million kWh by waste heat plants in June, 1954.

TABLE II.—ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Area Board	Totals for June (million kWh)			Twelve Months Totals Ended 30th June (million kWh)		
	1953	1954	Inc. or Dec. %	1953	1954	Inc. or Dec. %
London	366·6	387·5	+ 5·7	5,657·5	5,832·5	+ 3·1
South Eastern	223·3	240·6	+ 7·7	3,281·6	3,487·7	+ 6·3
Southern	265·0	293·1	+10·6	3,836·8	4,093·8	+ 6·7
South Western	127·0	153·8	+21·1	1,842·4	2,034·8	+10·4
Eastern	371·9	399·3	+ 7·4	5,333·8	5,648·8	+ 5·9
East Midlands*	328·5	353·5	+ 7·6	4,551·2	4,806·1	+ 5·6
Midlands*	425·5	478·8	+12·5	6,048·1	6,493·5	+ 7·4
South Wales*	264·8	302·5	+14·2	3,336·0	3,745·8	+12·3
Merseyside and N. Wales* ...	247·5	282·2	+14·0	3,372·9	3,663·6	+ 8·6
Yorkshire*	444·5	470·1	+ 5·8	5,929·5	6,306·1	+ 6·4
North Eastern*	266·2	281·7	+ 5·8	3,542·8	3,761·5	+ 6·2
North Western*	477·3	520·8	+ 9·1	6,481·3	7,069·4	+ 9·1
South East Scotland	88·1	101·1	+14·8	1,257·5	1,370·2	+ 9·0
South West Scotland* ...	210·4	237·5	+12·9	3,045·4	3,249·0	+ 6·7
Total all Area Boards ...	4,106·6	4,502·5	+ 9·6	57,516·8	61,562·8	+ 7·0
Direct Supplies by Central Authority	82·3	94·5	+14·8	831·4	1,060·8	+27·6
Grand Total	4,188·9	4,597·0	+ 9·7	58,348·2	62,623·6	+ 7·3
Mainly Industrial Areas* ...	2,664·7	2,927·1	+ 9·8	36,307·2	39,095·0	+ 7·7
Mainly Non-Industrial Areas	1,441·9	1,575·4	+ 9·3	21,209·6	22,467·8	+ 5·9
Total Number of Effective Working Days	27·29	27·11				

* Those in which industrial consumers took over 50% of the total sales in the preceding financial year.

Carmarthen Bay Station

Carmarthen Bay power station, South Wales, is to be officially opened on 27th August by Sir Henry Self, deputy chairman (administration) of the British Electricity Authority.

Power Stations and Pollution

Northumberland County Council has asked the Ministry of Housing and Local Government for further information on the Ministry's recent recommendation to Newburn Council that no house building should take place for some years on the Union Hall estate because of the likelihood of severe atmospheric pollution from the new Stella North and South power stations. In a letter to the Ministry the County Council stated that when a public inquiry was held into the power stations plan no reference was made to the possibility of severe atmospheric pollution. It was inconceivable that the B.E.A. and the Ministry of Fuel should have permitted the power stations to be built if the consequences were to be so grave, not only to the land in the locality but to the health of the existing community. The letter stated that if pollution at Union Hall made it advisable to postpone building there, the effects of such pollution were unlikely to be confined to that area. The County Council asked the Ministry to state on what information the comments regarding pollution were based.

Siting of Atomic Plants

In reply to a suggestion by Consett (Durham) Urban District Council that an atomic power plant should be built in North-West Durham, the Board of Trade has pointed out that when atomic power plants are contemplated, consideration will be given to areas where there is unemployment. Development plans of the Consett Iron Co. should safeguard the employment position at Consett for a long time.

Cooker Points Replace Open Grates

Points for electric cookers will in future be installed in certain types of flats to be erected by Helston (Cornwall) Borough Council, to take the place of the present living room open grate and oven. The Town Clerk (Mr. S. Askew) reported to the Council that the change-over would save £20 on the structural cost of each flat.

Consent to Overhead Lines

Spennymoor (Co. Durham) U.D.C. has consented to the supply of electricity to the village of Byers Green by means of overhead lines. The Council was informed by the North Eastern Electricity Board that if it insisted on underground cables it would add to the cost of supplying energy and also cause a delay in carrying out the work.

Early Closing of Showrooms

In reply to an inquiry by the Southern Electricity Consultative Council on the question of changing the early closing day of showrooms so that they remain open on Saturday afternoons, the Board said that experience had shown that little business had been done on Saturday afternoons and that the interest of the majority of consumers was best served by showrooms being open on the early closing day of shops. The Electricity Consultative Council is asking the Board for further evidence on the business done at showrooms in Southampton which are open on Saturday afternoons.

Border Rural Supplies

Recently a deputation from the South East Scotland Electricity Board visited London to discuss with the British Electricity Authority the question of rural development in the Border area, particularly North Northumberland. As a result, it is now announced that a further allocation of £65,000 is to be made available. At the last meeting of the Consultative Council Brigadier Cunningham, one of the deputation, said they were told that things were now easier and if the Board could use the money it would be available. There was a doubt whether the Board could do so this year, however, owing to staff problems, getting surveys, wayleaves, etc.

New S.E.E.B. Showrooms

A NEW showroom was opened by the South Eastern Electricity Board at West Wickham, Kent, on 9th July, and on the same day extensions were formally opened at the Tonbridge showroom.

The opening ceremony at West Wickham was performed by Mr. W. R. T. Skinner, deputy chairman of the Board, who said that when "Seeboard" started its operations it had 859,000 consumers. Since then it had provided supplies for almost 200,000 further users. The showroom was the tenth new showroom the Board had provided, bringing the present total up to 92.

The colour scheme of the showroom interior is particularly striking, full use being made of light and dark effects to emphasize or reduce particular aspects of the building. The showroom will provide facilities for some 8,000 consumers in the West Wickham neighbourhood, and replaces the part-time payment of bills arrangement with the South Eastern Gas Board at its showroom. The first purchaser of electrical equipment was Mrs. I. G. Darrant, of West Wickham, to whom was presented a Morphy-Richards automatic toaster as a memento of the occasion. Mr. G. E. Thomas is in charge of the new showroom.

At Tonbridge, "Seeboard" (Tunbridge Wells District) has extended its premises at 111, High Street, by converting the adjacent property into a combined demonstration theatre and showroom. This extension also has more than doubled the window display area. On the opening day Mrs. Marguerite Patten, the B.B.C. radio and television cookery expert, gave three demonstrations. The first of these was given to the invited audience at the opening of the extension in the morning, the remaining two being given one in the afternoon to the combined audiences of the Tonbridge and Tunbridge Wells Branches of the Electrical Association for Women, and in the evening to members of the public. Mr. N. Boydell, M.I.E.E., A.M.I.Mech.E. (Sub-Area manager), introduced Councillor Mr. F. W. E. Dawes, J.P. (chairman of the Tonbridge Urban District Council), who performed the official opening. Amongst those present were the Tunbridge Wells district manager (Mr. T. W. Dann) and Mrs. Dann; Major F. Springate (deputy manager, Tunbridge Wells and late manager at Tonbridge); Mr. G. H. Ingamells (Sub-Area commercial officer); Mrs. Hyatt-Woolf (chairman of the Tonbridge Rural District Council); Councillor Mr. A. F. Hollins (chairman of the District Committee of the Consultative Council); Miss M. A. Coward (member of the District Committee of the Consultative Council); Mr. B. Bishop (engineer and surveyor, Tonbridge U.D.C.), and Mr. D. E. Keen (housing manager, Tonbridge U.D.C.). As a memento of the occasion, Mr. Boydell presented Councillor Mr. Dawes with an engraved electric clock.

Judgment on B.E.A. Claim

IN the Chancery Division last week Mr. Justice Harman gave a reserved judgment on a claim by the British Electricity Authority against the Morecambe and Heysham Corporation. At the hearing on 2nd July Mr. H. Willis, Q.C., for the plaintiffs, said that the municipal electricity undertaking's assets were on 1st April, 1948, vested in the plaintiffs, who claimed that for the two financial years before that date the Corporation had unlawfully applied money belonging to the undertaking in aid of the local rates. Such money should have been included in the assets transferred to the plaintiffs. The total sum involved was £38,375. Plaintiffs had to take over and defray an overdraft of about £50,000, which would have been less but for the action of the Corporation.

Sir Andrew Clark, Q.C., for the Corporation, said that by virtue of the Morecambe Corporation Act, 1924, which provided for the pooling of municipal reserves and contained no express restrictions on the use of surplus revenue, the money was carried to and formed part of the general rate fund. The Corporation did not hold the money in their capacity of electricity undertakers.

Giving judgment, His Lordship said that the writ was issued on 29th March, 1949, and it took the plaintiffs four years to produce their statement of claim, a period of gestation which would be unbelievable in any ordinary commercial concern. The plaintiffs alleged that the accounts had been manipulated in favour of the ratepayers so as to milk the undertaking of financial assets which should have passed to the plaintiffs on 1st April, 1948. The defendants, while not denying the transfers to the rate fund of which complaint was made, maintained that they were within their powers. He held that the plaintiffs (1) failed in their claim that the defendants had, in the two years before the undertaking vested in them, wrongly transferred two sums of £24,883 and £13,492 from the electricity undertaking account to the general rate fund; but (2) succeeded in their claim that two sums of £8,000 and £4,871 had been wrongly transferred from the electricity reserve fund. Each party should pay its own costs.

The new showroom of the South Eastern Electricity Board at West Wickham (left) and part of the extension at Tonbridge (right)

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 1st September from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1950

14659. Unity Heating, Ltd.—Electric heating elements and method of making same. 20th September, 1951. (714576.)

14713. Western Electric Co., Inc.—Microwave amplifiers. 13th June, 1950. (714832.)

22315. Sarum Electric, Ltd., and Sparrow, G. E.—Safety or protective cut-outs for electrical immersion heaters. 11th December, 1951. (714675.)

29325. Delapena & Son, Ltd.—High frequency induction heating apparatus. 14th November, 1951. (714488.)

29714. Compagnie Générale de Téléraphie sans Fil.—Electronic tube functioning as an oscillator by the effect of interaction between several electronic streams of different velocities. 5th December, 1950. (714755.)

30111. British Thomson-Houston Co., Ltd.—Dynamo-electric machines. 10th December, 1951. (714677.)

1951

2006. Ferranti, Ltd.—Protective arrangements for liquid-immersed electrical apparatus. 16th March, 1952. (714678.)

6644. General Electric Co., Ltd., Humphrey, R., and Rycroft, J. L.—Electric supply connectors. 20th March, 1952. (714838.)

7352. Marconi's Wireless Telegraph Co., Ltd.—Cathode-ray tube flying spot scanners. 11th February, 1952. (714586.)

7646. English Electric Co., Ltd.—Panel-mounting cases for electrical apparatus. 28th March, 1952. (714686.)

8283. Western Electric Co., Inc.—Method of desulphurizing carbon-coated electrodes. 10th April, 1951. (714588.)

8628. Heinrich, D. O.—Electrostatic precipitators. 30th January, 1952. (714589.)

8695. General Electric Co., Ltd., and Higgins, C.—Electric circuit arrangements comprising electric discharge lamps. 17th March, 1952. (714687.)

10035. Carron Co., and Philip, A. R.—Cookers with provision for electrically heated utensils. 2nd May, 1952. (714689.)

10127. Camillerapp, M. M. — Electric lamps. 30th April, 1951. (714761.)

10602. D.S. Plugs, Ltd.—Electric tumbler switches. 25th July, 1952. (714762.)

11593. General Electric Co., Ltd., and Rigden, S. A. R.—Electric discharge lamps and electrodes therefor. 22nd February, 1952. (714842.)

16842. Ward, T. A. B.—Apparatus for heating water electrically. 16th July, 1952. (714767.)

18180. Ferranti, Ltd. — Transmitting apparatus for remote indicating systems. 24th October, 1952. (714700.)

19956. Electric & Musical Industries, Ltd.—Method for the soldering of articles consisting of aluminium or alloys thereof. 12th August, 1952. (714510.)

21168. Standard Telephones & Cables, Ltd.—Electromagnetic deflection systems for cathode-ray tubes. 7th September, 1951. (714770.)

23157. Metropolitan-Vickers Electrical Co., Ltd.—Apparatus for tensioning wires, bands, and like strip material. 22nd September, 1952. (714515.)

23251. Metropolitan-Vickers Electrical Co., Ltd.—Electromagnetic relays. 27th August, 1952. (714516.)

24612. Foxboro Co.—Electrical capacity measuring circuit. 22nd October, 1951. (714861.)

25505. Siemens & Halske Akt.-Ges.—Counting devices. 31st October, 1951. (714775.)

26345. General Electric Co., Ltd., and Jones, H. F.—Spark gap assemblies for electrical surge divertors. 4th November, 1952. (714776.)

28856. Rotax, Ltd.—Snap-action electric switches. 9th December, 1952. (714608.)

29130. Süddeutsche Laboratorien Ges.—Apparatus for heating by electronic bombardment. 12th December, 1951. (714612.)

29777. Drilling by electrons. 19th December, 1951. (714613.)

29824. Badische Anilin- & Soda-Fabrik.—Metal powders for magnetic mass cores. 20th December, 1951. (714520.)

30132. Murphy Radio, Ltd.—Time base circuits for radar apparatus. 24th December, 1952. (714521.)

1952

564. Philips Electrical Industries, Ltd.—Cathode-ray apparatus. 8th January, 1952. (714718.)

2730. Armour Research Foundation of Illinois Institute of Technology.—Magnetic transducing assembly. 1st February, 1952. (714621.)

3277. Metropolitan-Vickers Electrical Co., Ltd.—Electric transformers and the like. 9th January, 1953. (714524.)

4710. Westinghouse Brake & Signal Co., Ltd., Walker, A. H. B., and Marten, R. G.—Apparatus for the production of a substantially constant voltage from a variable voltage source. 4th December, 1952. (714626.)

4787. Elliott Bros. (London), Ltd.—Means for delaying electric impulses. 23rd February, 1953. (714627.)

4861. Switchgear & Cowans, Ltd., and Rowland, F. G.—Air-break circuit breakers. 11th February, 1953. (714526.)

4894. General Electric Co., Ltd., and Sowter, A. B.—Cold pressure welding. 28th January, 1953. (714787.)

5376. Philips Electrical Industries, Ltd.—Circuits for transforming the frequency of high-frequency oscillations. 29th February, 1952. (714528.)

5892. Sylvania Electric Products, Inc.—Luminescent materials. 6th March, 1952. (714791.)

6212. Marconi's Wireless Telegraph Co., Ltd.—Preparation of germanium metal for use in semi-conductor electrical devices. 26th November, 1952. (714875.)

6338. Rosner, E.—Light-current electric switches. 11th March, 1952. (714730.)

7806. May & Baker, Ltd.—Electrically heated drying ovens. 26th March, 1952. (714637.)

8975. Sangamo Weston, Ltd.—Electrical indicating or measuring instruments of the moving iron type. 8th April, 1953. (714534.)

9122. Bendix Aviation Corporation.—Switch for electromagnetic waveguides. 9th April, 1952. (714879.)

9407. Igranic Electric Co., Ltd.—Control systems for electric multi-motor drives. 15th April, 1952. (714735.)

9556. Metropolitan-Vickers Electrical Co., Ltd.—Control of mine hoists and the like winding equipment. 14th April, 1953. (714882.)

10066. Allmanna Svenska Elektriska Aktiebolaget.—Ionic valves. 22nd April, 1952. (714798.)

12783. Telemecanique Electrique.—Thermally responsive automatic electric cut-out or circuit breaker. 20th May, 1952. (714646.)

13024. General Electric Co., Ltd.—Apparatus for high-frequency electric induction heating. 22nd May, 1953. (714742.)

13366/7. Ward & Goldstone, Ltd., and Couyoumdjian, A. O.—Electric plug-and-socket couplings. 27th May, 1953. (714889 and 714802.)

13904. General Motors Corporation.—Manufacture of commutators for dynamo-electric machines. 3rd June, 1952. (714744.)

14296. Allmanna Svenska Elektriska Aktiebolaget.—Air-blast electric circuit breakers. 6th June, 1952. (714538.)

15887. Compagnie des Machines Bull.—Pulse generating systems. 24th June, 1952. (714746.)

16112. British Thomson-Houston Co., Ltd.—Apparatus for making mounts for tubular electric lamps. 26th June, 1952. (714543.)

18861. Philips Electrical Industries, Ltd.—Radio receiving circuits with silent tuning. 25th July, 1952. (714548.)

19524. Philips Electrical Industries, Ltd.—Electro-mechanical counting devices. 1st August, 1952. (714751.)

19834. Bendix Aviation Corporation.—Induction generator. 6th August, 1952. (714549.)

19914. Scheid, A. M., Scheid, E. M., and Scheid, W. M. (trading as Vorwerk & Co.).—Vacuum cleaners. 7th August, 1952. (714808.)

20158. British Thomson-Houston Co., Ltd.—Apparatus for bending tubular lamps. 11th August, 1952. (714894.)

21127 and 22367. Western Electric Co., Inc.—Electric signal translating devices employing transistors. 22nd August and 5th September, 1952. (714811/2.)

24237. Sylvania Electric Products, Inc.—Holders for elongated electric lamps. 26th September, 1952. (714815.)

25471. Belling & Lee, Ltd.—Electrical multi-contact connectors. 10th October, 1952. (714818.)

25881. General Electric Co.—Arc welding apparatus. 15th October, 1952. (714901.)

26932. Philips Electrical Industries, Ltd.—Electronic data-storing circuits. 27th October, 1952. (714667.)

29864. Aktiebolaget Tudor.—Connecting and cooling arrangements in electric storage batteries. 25th November, 1952. (714824.)

30263. Telefunken Ges. für Drahtlose Telegraphie.—Very high frequency valve and wave guide installations. 28th November, 1952. (714827.)

30644. Sperry Products, Inc.—Method and apparatus for the ultrasonic inspection of solid objects. 3rd December, 1952. (714564.)

31781. Soc. Francaise Radio-Electrique.—Pulse signal apparatus and systems. 15th December, 1952. (714908.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 7th August:—

MAGNETROL. No. 719,891, Class 9. Voltage and current stabilizers, rectifiers, transformers, battery eliminators, battery chargers and field and armature controllers and parts.—Winston Electronics, Ltd., 1, Park Road, Hampton Hill, Hampton, Middx.

NICA. No. 729,821, Class 9. Electric accumulators and batteries; and measuring apparatus.—Svenska Ackumulator Aktiebolaget Jungner, Stockholm, Sweden. Address for service, c/o Reddie & Grose, 6, Bream's Buildings, London, E.C.4.

BAK-VAK. No. 729,893, Class 9. Electric vacuum cleaners.—New Welbeck, Ltd., 120, New Bedford Road, Luton, Beds.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia. — BRISBANE. — 10th September City Council. 1,300 bracket type street lighting lanterns, 200 suspension type street lighting lanterns and 120 spare refractors. (E.S.B. 17039/54. Ten/9926.)*

Belfast.—13th August. Electricity Department. Replating cells of storage battery at East Bridge Stteet station. (See this issue.)

Bradford.—16th August. City Council. Electrically driven, vertical spindle centrifugal pumps and complete installations for two pumping stations at Tong. City engineer.

Canada. — WINNIPEG. — 30th August. Manitoba Hydro - Electric Board. Two steam generating units for Brandon generating station. (E.S.B. 17406/54. Ten/9966.)*

City Hydro-Electric System. Carrier current control equipment. (E.S.B. 17438/54. Ten/9978.)*

Edinburgh.—North of Scotland Hydro-Electric Board. Electric lighting, heating and other subsidiary services for Quoich power station. (See this issue.)

Egypt.—CAIRO.—22nd September. Municipalities Administration, Ministry of Municipal and Rural Affairs. 600 h.p. generating set for Beni Souef station. (E.S.B. 17100/54. Ten/9951.)*

Formosa.—TAIPEI.—10th August. Central Trust of China. 30 kW diesel generating set, portable centrifugal pumps, etc. (E.S.B. 17061/54. Ten/9898.)* 11th August. 350 h.p. induction motors, centrifugal pumps, etc. (E.S.B. 17066/54. Ten/9897.)* 13th August. 250 kVA diesel-electric standby power unit. (E.S.B. 17062/54. Ten/9902.)* 30th August. Switchboards, transformers, capacitors, cable and potheads. (E.S.B. 17071/54. Ten/9901.)*

Heckmondwike.—6th August. U.D.C. Electrical work in aged persons' dwellings in Strawberry Square. Surveyor, Council Offices, Oldfield Lane.

India.—BANGALORE.—16th August. Stores Purchase Committee, Government of Mysore. Two 1,000 kVA transformers and accessories. (E.S.B. 17054/54. Ten/9913.)*

NEW DELHI. — 20th August. Director General of Supplies and Disposals. V.i.r. cable. (E.S.B. 17466/54. Ten/9958.)*

Irish Republic. — CORK. — 7th August. County Council. Pumps and motors for regional water supply scheme. (E.S.B. 17221/54. Ten/9944.)* X-ray apparatus. (E.S.B. 17589/54. Ten/9981.)*

London. — WANDSWORTH. — 25th August. Corporation. Repair of 700 time switches. (See this issue.)

New Zealand. — WELLINGTON. — 19th August. Post and Telegraph Department. Conduit for lead covered telephone cables. (E.S.B. 17133/54. Ten/9939.)*

Northern Rhodesia. — KITWE. — 26th August. Town Council. Electric cable, switchgear and transformers. (E.S.B. 17264/54. Ten/9936.)*

Pakistan.—KARACHI.—24th August. Department of Supply and Development. Fifty-six transformers of 10–200 kVA ratings. (E.S.B. 17472/54. Ten/9961.)* 7th September. 72 kW water turbine and generator with ancillary equipment. (E.S.B. 17249/54. Ten/9923.)*

Portugal.—LISBON.—11th August. Directorate General of Hydraulic Services. Electro-mechanical equipment and pipe line for Silvas elevating station. (E.S.B. 17583/54. Ten/9980.)* 18th August. Electro-mechanical equipment the for Arade hydro-electric power station. (E.S.B. 17028/54. Ten/9919.)*

Romford.—11th August. Corporation. Street lighting equipment. (See this issue.)

South Africa.—PRETORIA.—5th August. Union Tender and Supplies Board. 6,000,000 insulated steel staples. (E.S.B. 17105/54. Ten/9924.)*

Southern Rhodesia. — CAUSEWAY. — 30th July. Department of Health. Mobile X-ray plant. (E.S.B. 17135/54. Ten/9948.)* 30th July. One mobile short-wave therapy apparatus. (E.S.B. 17265/54. Ten/9957.)* One complete electro-surgical diathermy apparatus and accessories. (E.S.B. 17263/54. Ten/9965.)*

Spilsby.—23rd August. R.D.C. Centrifugal pumps and ejectors (separate contracts) to be installed complete with electric motors and switchgear, etc., in eight pumping stations. Binnie, Deacon & Gourley, engineers, Artillery House, Artillery Row, Westminster, S.W.1.

Stoke-on-Trent.—29th July. Corporation. Electric lamps for six months. City surveyor, Town Hall.

Tangier.—27th September. Water and Electricity Supply Board. Uncovered copper cable. (E.S.B. 17048/54. Ten/9917.)*

Uruguay. — MONTEVIDEO.—26th August. Usinas Electricas y los Telefonos del Estado. Columns, reflectors, street lighting devices and lamps. (E.S.B. 17113/54. Ten/9945.)*

ORDERS PLACED

Blackpool.—Corporation Highways Committee. We are informed by the Stearn Electric Co., Ltd., that it is not supplying chokes and capacitors, as reported in our issue of 16th July.

London. — Metropolitan Water Board. Seven electrically-operated headstocks to work with existing 18in diameter sluice valves, complete with motors and starters, for the Lee Bridge Works (£2,100).—Guest & Chrimes, Ltd.

Lyme Regis.—Corporation. Installation of an improved street lighting scheme (£1,641). —South Western Electricity Board.

Southampton.—Corporation. 600 lamp standards.—Concrete Utilities, Ltd. 600 street lighting lanterns and fittings.—General Electric Co., Ltd.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Acton.—Three-storey premises; T. Wall & Sons, Ltd., The Friary, Acton, W.3.

Barrow-in-Furness.—Extensions to factory at Duke Street for Gilbert & Kellett, Ltd.; Wm. Hull & Sons, Ltd., Rawlinson Street, Barrow.

Birmingham.—Two multi-storey flatted factories in redevelopment areas at Dartmouth Street and Holloway Head; city architect.

Development of "Big Top" site, New Street corner, for shopping centre; Jack Cotton, Ballard & Blow, architects to developers, Cavendish House, Waterloo Street, 2.

Bournemouth.—Factory in Wallisdown Road; F. Barber & Son, Ltd., flooring contractors, 44, Denmark Road, Winton.

Brighton.—Flats (18) and shops (6), St. George's Road; borough engineer and surveyor, 26–30, King's Road, Brighton.

Burford.—Extensions to Grammar School (£92,000); county architect, Oxford.

Burnley.—Houses (61), as first section of scheme for 594 houses on the Bee Hole estate; borough surveyor, 22/24, Nicholas Street.

Chesterfield. —Additions to the College of Technology (£110,000); F. H. Crossley, county architect, St. Mary's Gate, Derby.

Cockfosters.—Housing estate, Cat Hill; James W. Walker, architect, Heddon Court Avenue.

Eccles.—Extensions to works at Silk Street for Synthetic Supplies, Ltd.; Taylor, Robert & Bowman, architects, 10 Clegg Street, Oldham.

Edgware.—Dwellings (44), Stonegrove; Circle Construction Co., Ltd., Wembley Hill Road, Wembley.

Halesowen.—Factory at Park Lane, Cradley, for Wombourn Manufacturing Co. Ltd.

Haltwhistle.—Modernization of paint factory including the installation of new electrical machinery; Smith & Walton, Ltd.

Harrow.—College of further education on the Northwick Park estate, including nine-storey teaching block, single-storey buildings for workshops, laboratories, drawing offices, etc., C. G. Stillman, Middlesex county architect.

Hartlepool.—Factory additions for J. B. Pillin, Ltd. (£30,000); Randle & Co., builders, Back Dunelm, Sunderland.

Haverfordwest.—Houses on the City Road estate (101) and at Jockey Fields (30); borough surveyor, 9, Victoria Place.

Hetton (Co. Durham).—Baths, canteen and medical centre at South Hetton Colliery; N.C.B. Architects' Department, Ashfield Towers, Gosforth, Northumberland.

Hull.—Houses (467), Longhill estate; A. Rankine, city architect, Lowgate.

Llangefni.—New factory for Welsh Agriculture & Industries, Ltd.; architects, T. A. Lloyd & Gordon, 6 Cathedral Road, Cardiff.

London. — BATTERSEA. — Dwellings (44), Sarsfield Road and Sisters Avenue; borough surveyor.

CITY.—Office Block, Mincing Lane, City of London Real Property Co., Ltd., 159, Fenchurch Street, E.C.3.

CLAPHAM.—Factory and offices, Foxley Road; Wm. Moss & Sons, Ltd., North Circular Road, N.W.2.

KENSINGTON.—Houses (176), in two stages in the Treverton Street area; J. W. Sainsbury, town clerk, Town Hall, W.8.

ST. PANCRAS.—Flats (214), Regent Square redevelopment scheme; town clerk, Town Hall, Euston Road, N.W.1.

Mitcham. —Central library extensions (£45,000); borough engineer.

Morpeth.—Additions to St. George's Hospital for Newcastle Hospital Board (£46,000); A. R. Robertson & Co., builders, East Park View, Blyth.

Newark.—Extensions to Kelham Sugar Factory; British Sugar Corporation, Ltd., 134, Piccadilly, London, W.1.

Newcastle-on-Tyne.—Proposed C. of E. and R.C. schools; city architect, 18, Cloth Market.

Plymouth.—Additional factory premises; Clatworthy's Ltd., Restola Works, Sutton Road.

Ripon.—Dwellings (42), Lead Lane estate; city engineer.

Southgate.—Works extensions, Chase Side; James Haworth & Brother, Ltd., 21, Soho Square, W.1.

Twickenham. — Works reconstruction; Granbull Tool & Engineering Co., Ltd., Edwin Road.

Whyteleafe.—Works extensions; The Thermal Co., Santas Works, Goldstone Road.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

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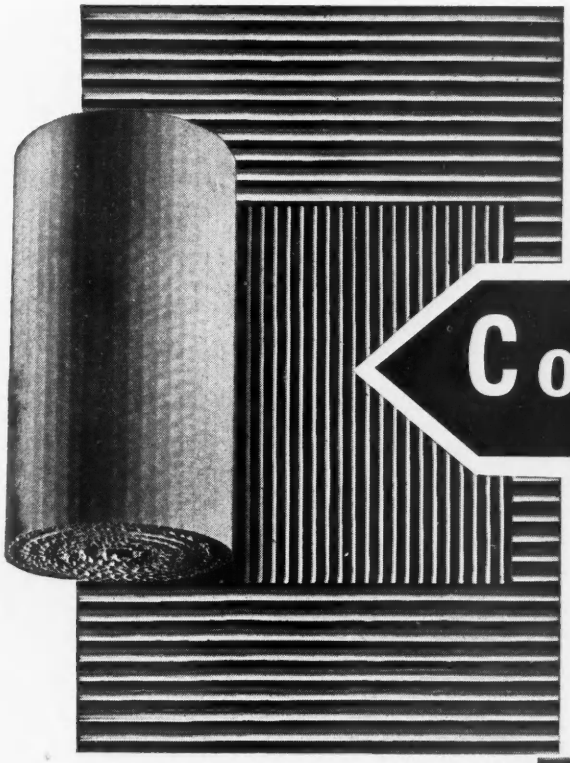

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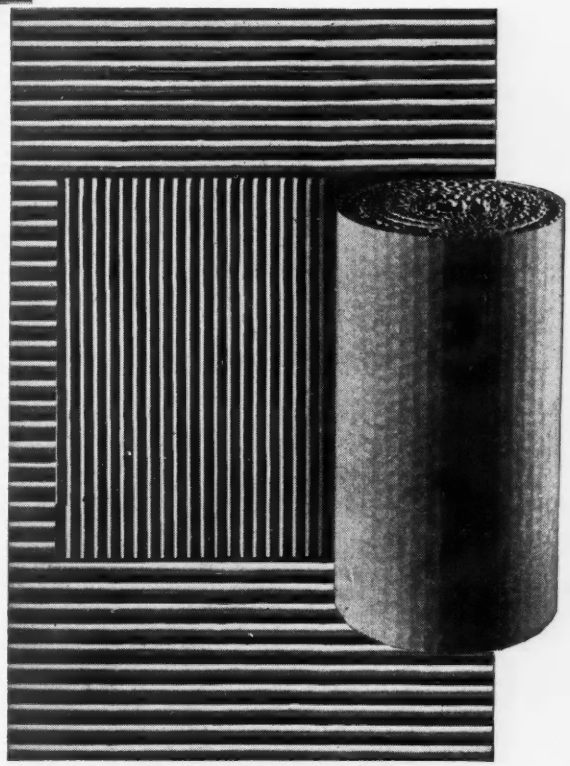

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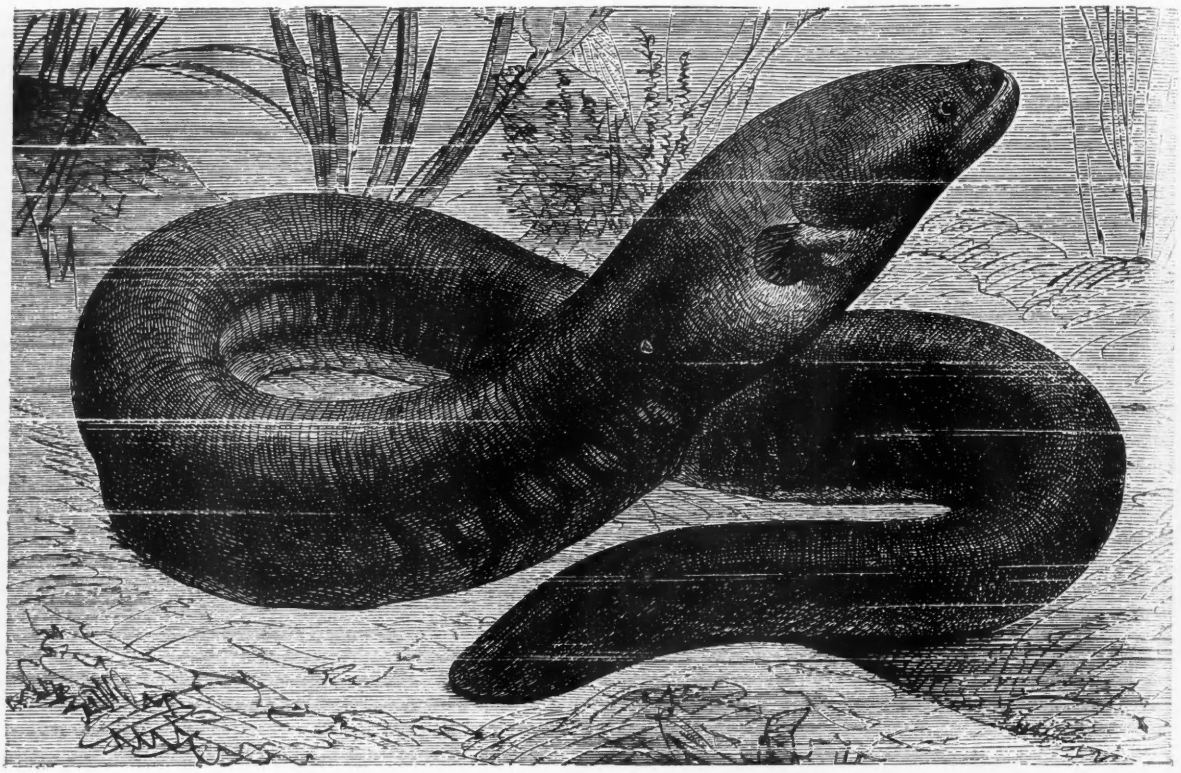

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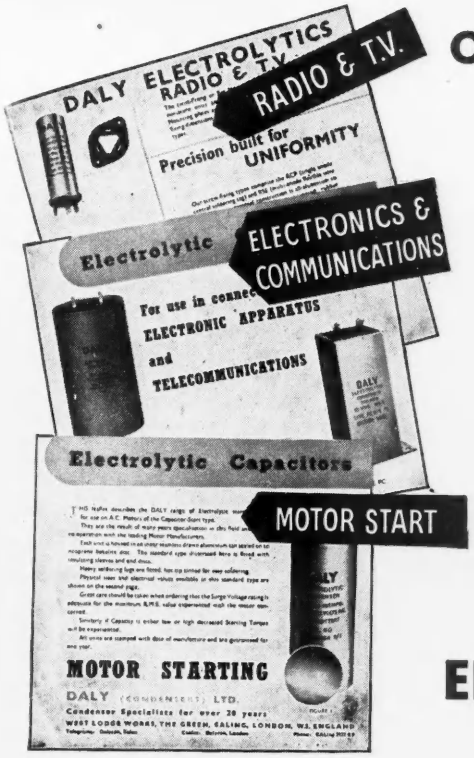

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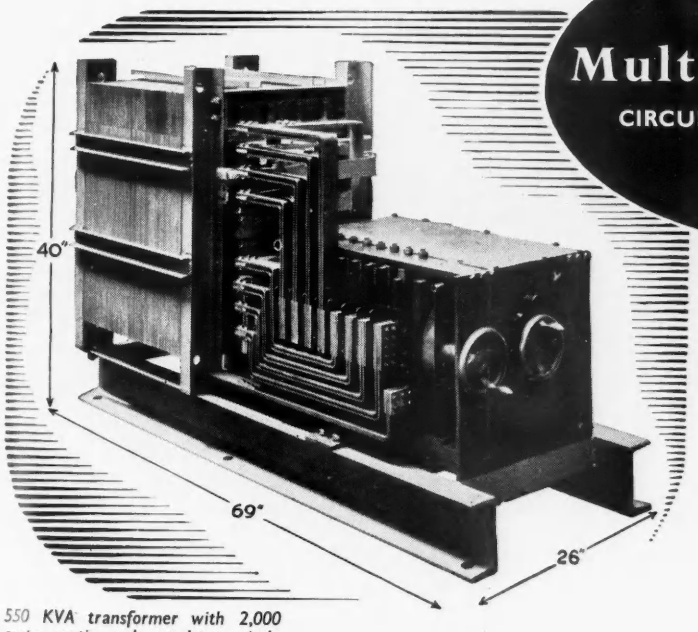

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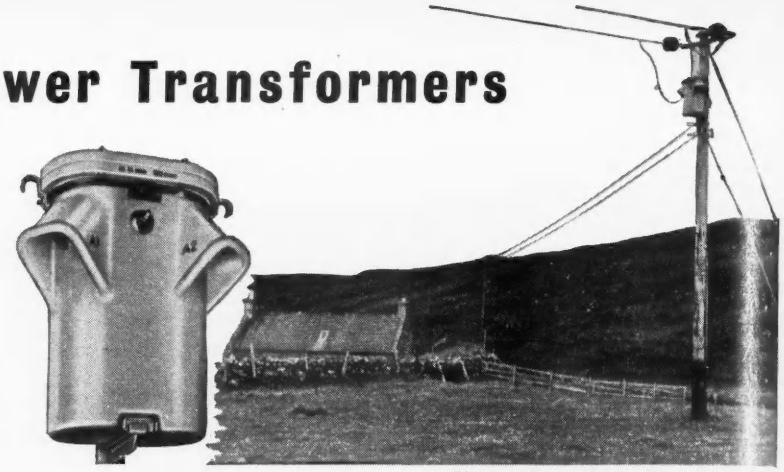
for rural distribution

in hermetically-sealed stoneware containers



Photograph by courtesy of British Insulated Callender's Construction Co. Ltd. and the North of Scotland Hydro-Electric Board.

- No maintenance costs. Containers are salt and acid proof. Supporting steel work is heavily galvanised. Hermetically sealed container protects oil from acidity.
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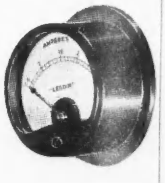

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Obtainable from all Leading Tool Merchants.

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Spindle Speed running light ...	2800 r.p.m.
Spindle Speed on full load	1500 r.p.m.
Watts input on full load	235 watts
Overall length	7½"
Distance from centre of spindle to outer casing	1"
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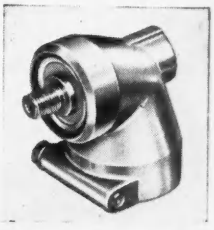
Low cost angle attachments convert the machine into an efficient corner drill. Attachment type ADA2c (as illustrated) is for use with chuck. Type ADA2q, a collet type attachment, is also available.



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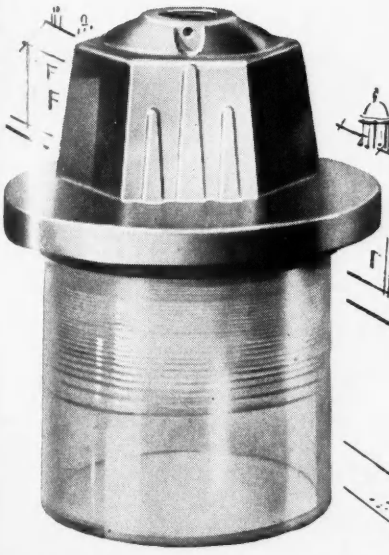
with the 'UNIVERSAL 100' (WATT)



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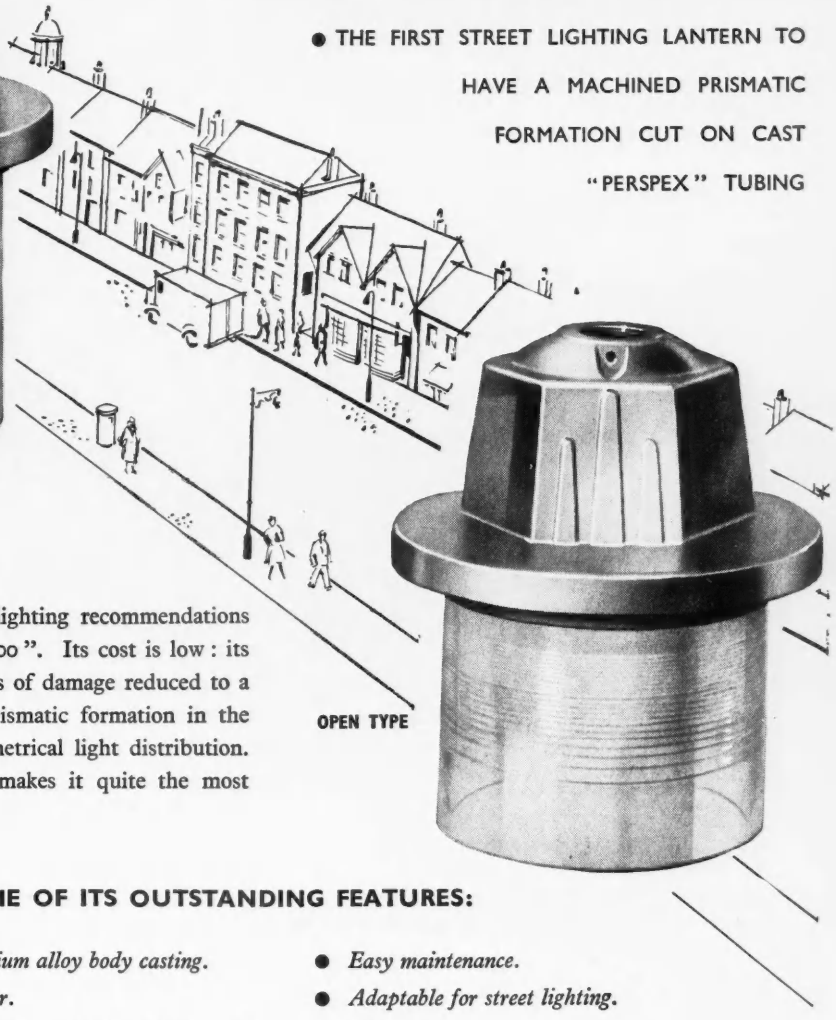
● THE FIRST STREET LIGHTING LANTERN TO HAVE A MACHINED PRISMATIC FORMATION CUT ON CAST "PERSPEX" TUBING



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BEFORE deciding on your street lighting recommendations you should see the "Universal 100". Its cost is low: its maintenance easy and the chances of damage reduced to a minimum. The machine cut prismatic formation in the "Perspex" refractor ensures symetrical light distribution. In fact, its all-round efficiency makes it quite the most attractive proposition available.

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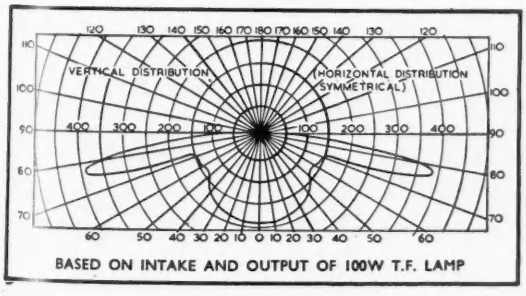

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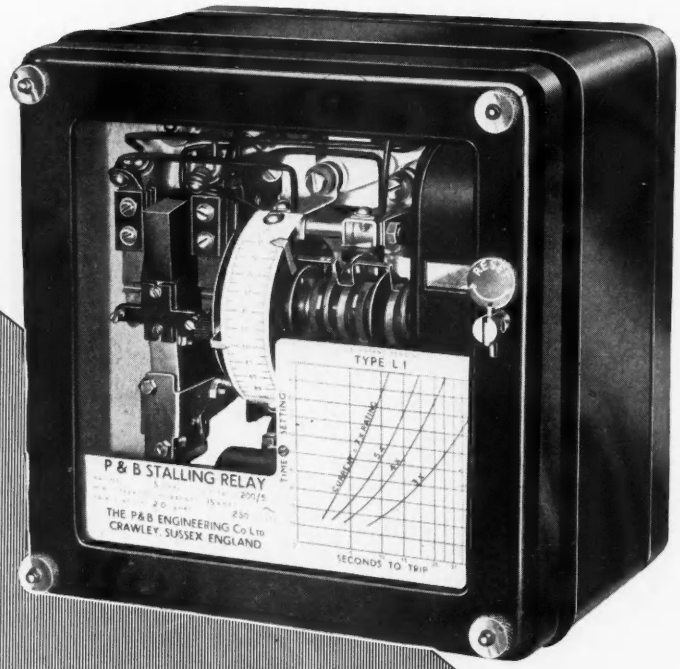

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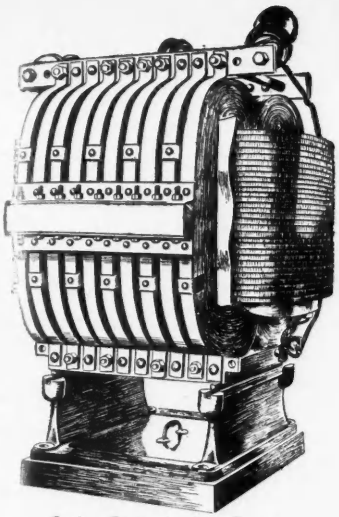

Early Ferranti transformer built in 1891 now in the Science Museum, S. Kensington

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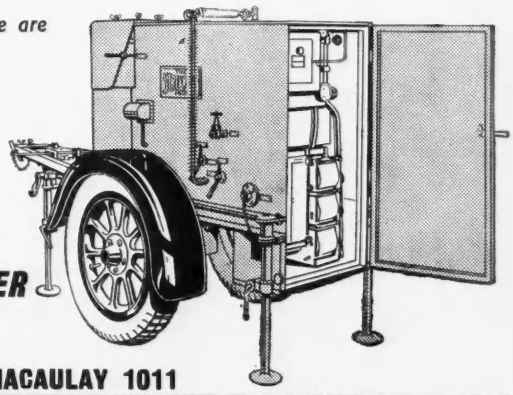

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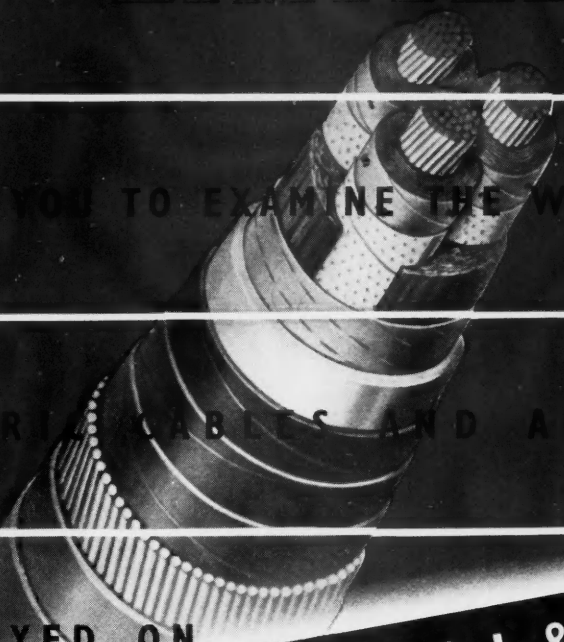

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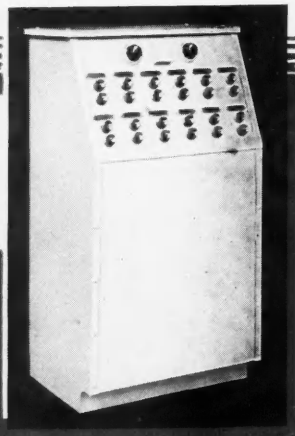
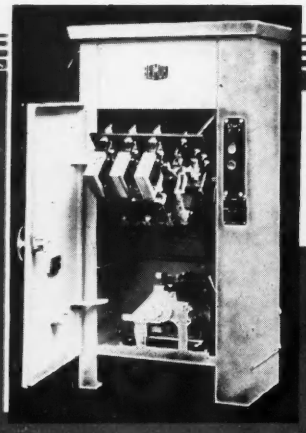


Remote Control Desk for group motor starting with indicator lamps.

A variety of arrangements is available to suit individual requirements.

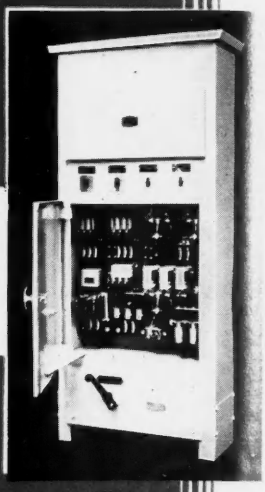


Type DO.75 Single Pillar motor starter showing accessibility of interior (isolator shield removed).

Fitted with local push-buttons and "Local Remote" rotary selector switch.

Type M. 150 Contactor Unit suitable for direct mounting on Capacitor tank for power factor correction.

Pillar-type motor starter incorporating three direct-on starters and one stator rotor starter arranged for automatic sequence control and fitted with isolating switch.



22 Unit Double Tier motor control switchboard comprising 300 amp. incoming switch and fuse unit, and contactors catering for various duties up to 100 H.P.

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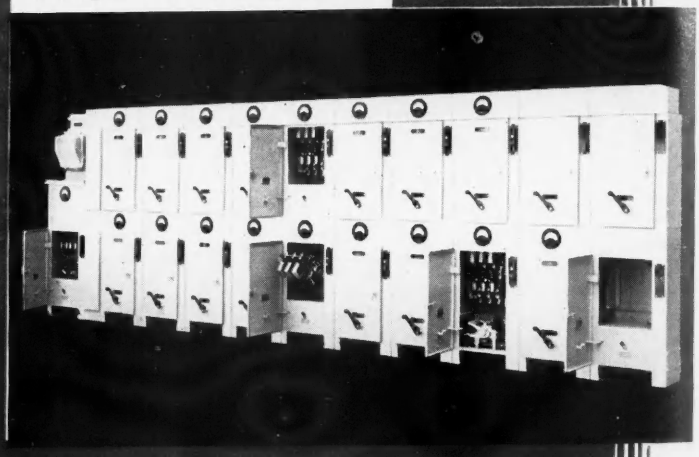
ELECTRIC MOTOR CONTROL GEAR

FOR INDUSTRIAL APPLICATIONS

(up to 650 volts A.C.)



Single Tier motor control switchboard with individual isolation, ammeters and arranged for local push-button control.

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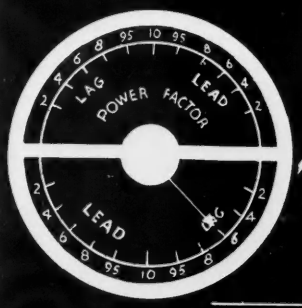

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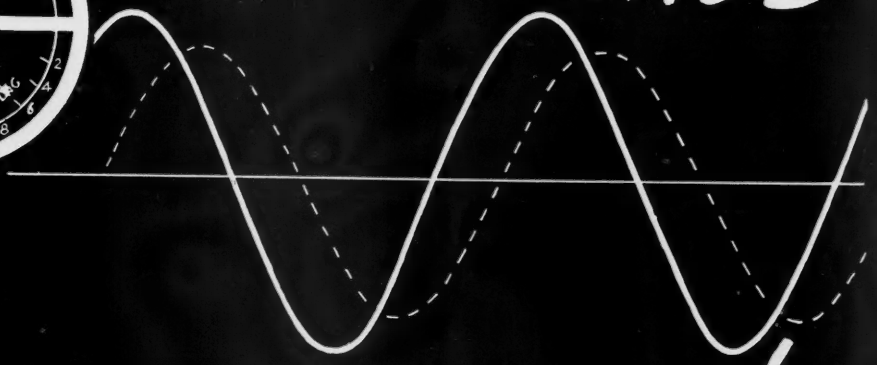

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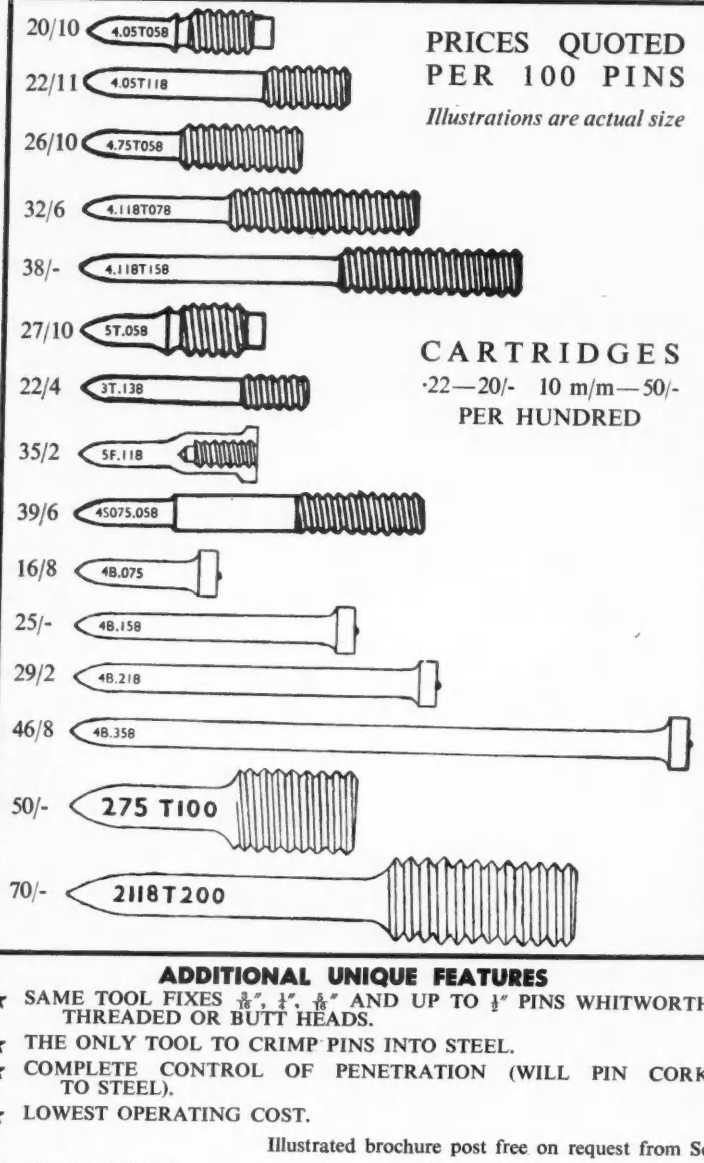

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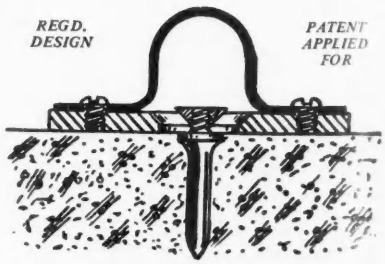

This pin is now available for fixing saddles to brick and concrete.

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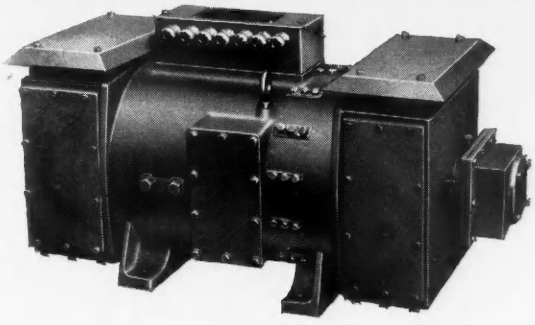

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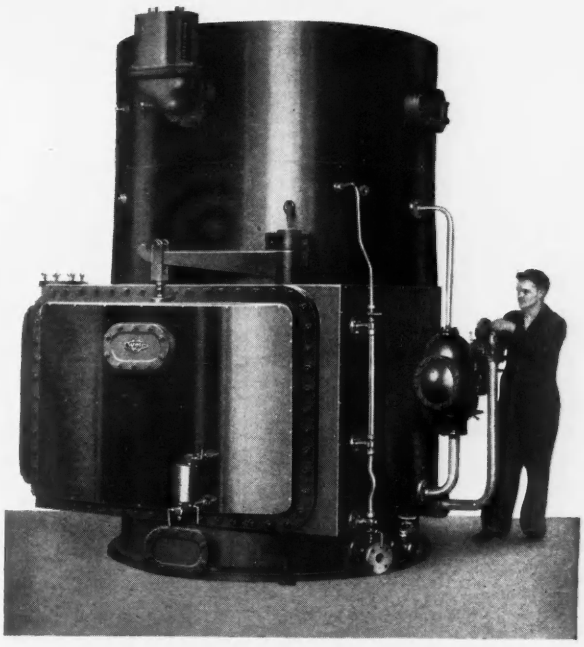

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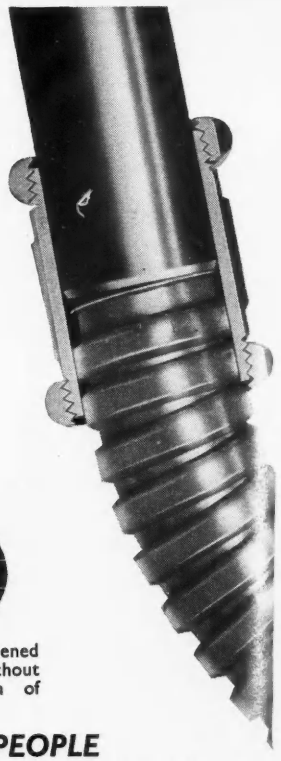

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For joining rigid to rigid (no screwing of conduit required)

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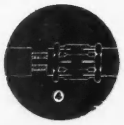

Joints may be opened at any point without dismantling run of conduit.

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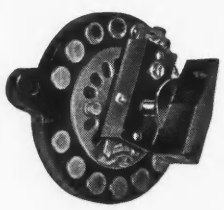

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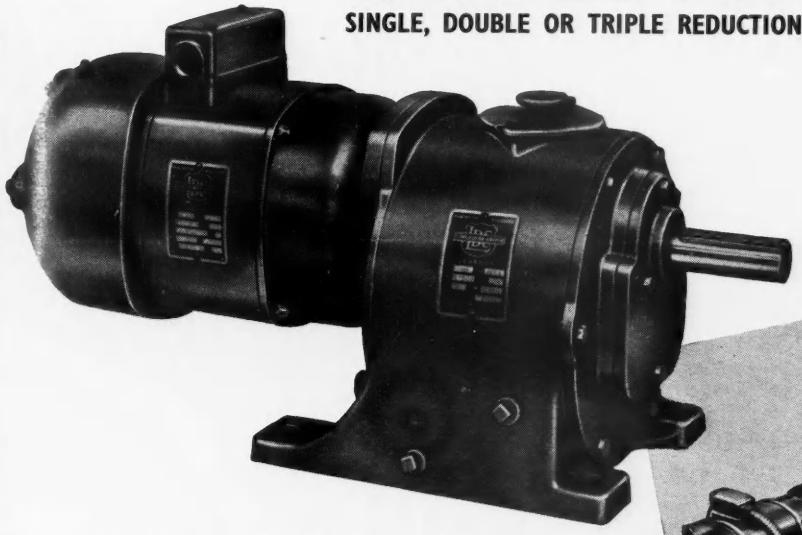

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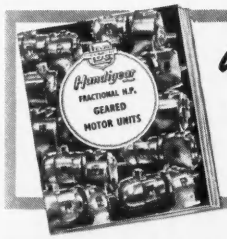

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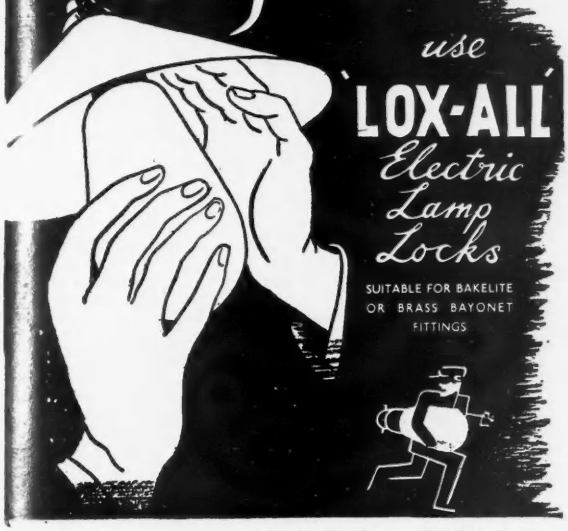

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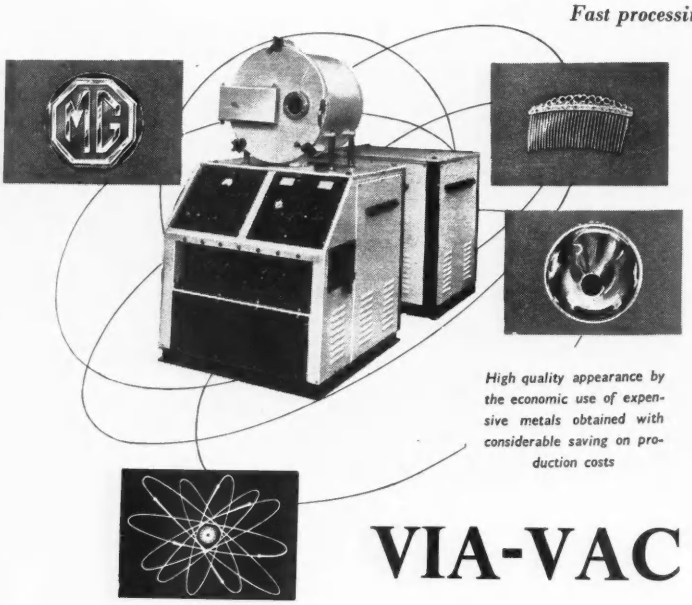

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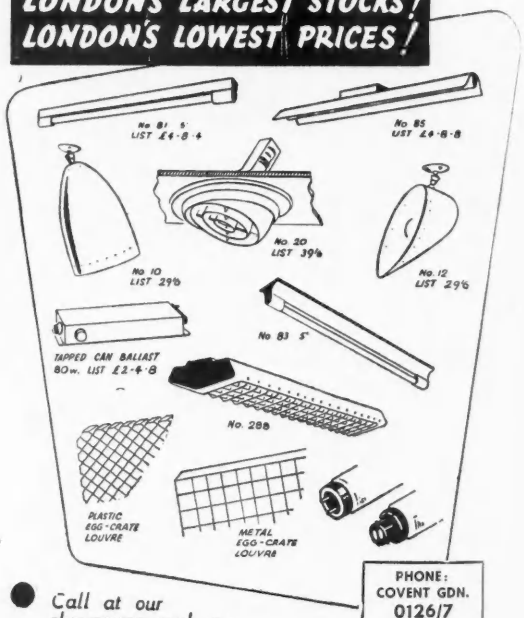

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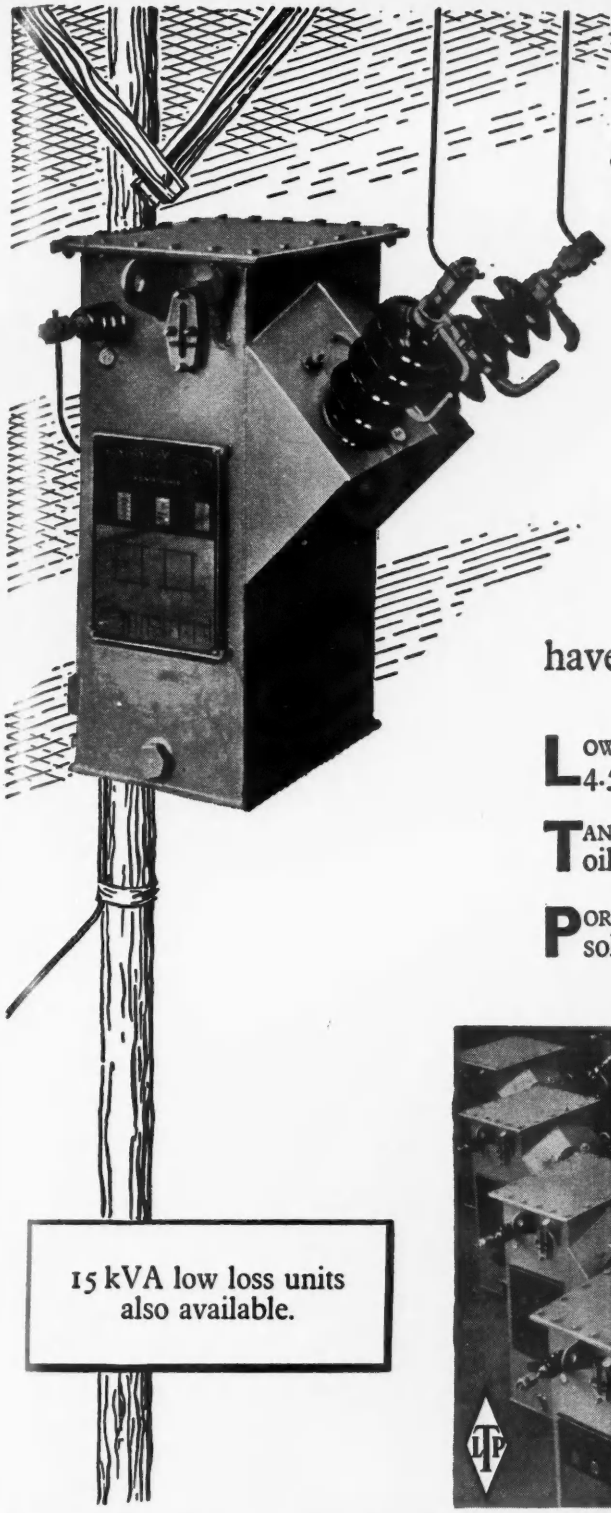

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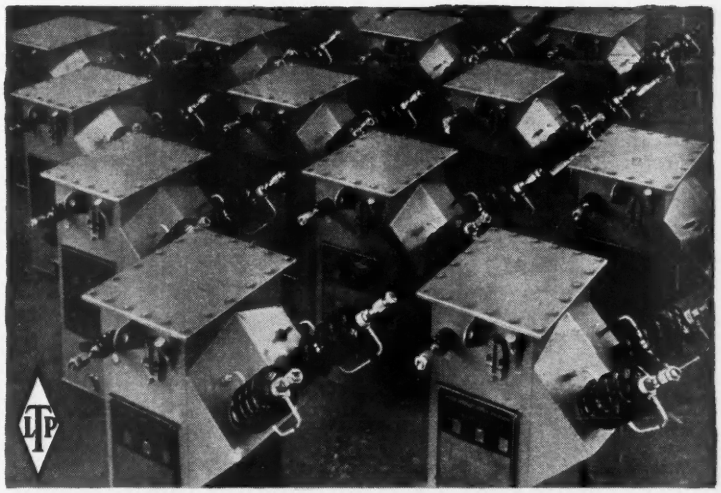

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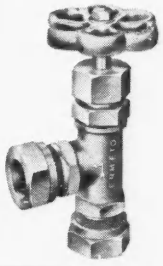

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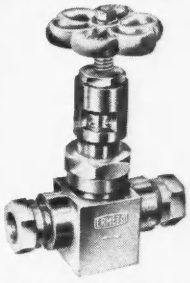

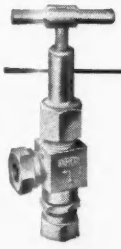

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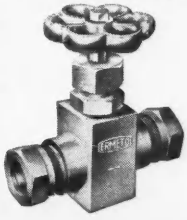

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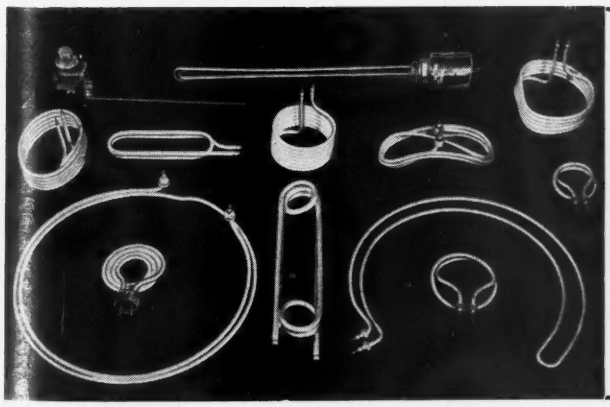

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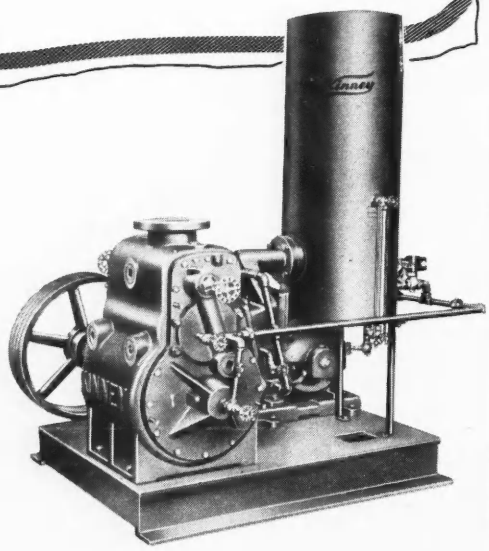

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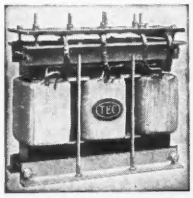

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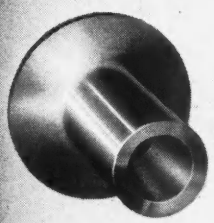

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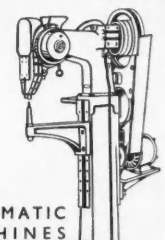

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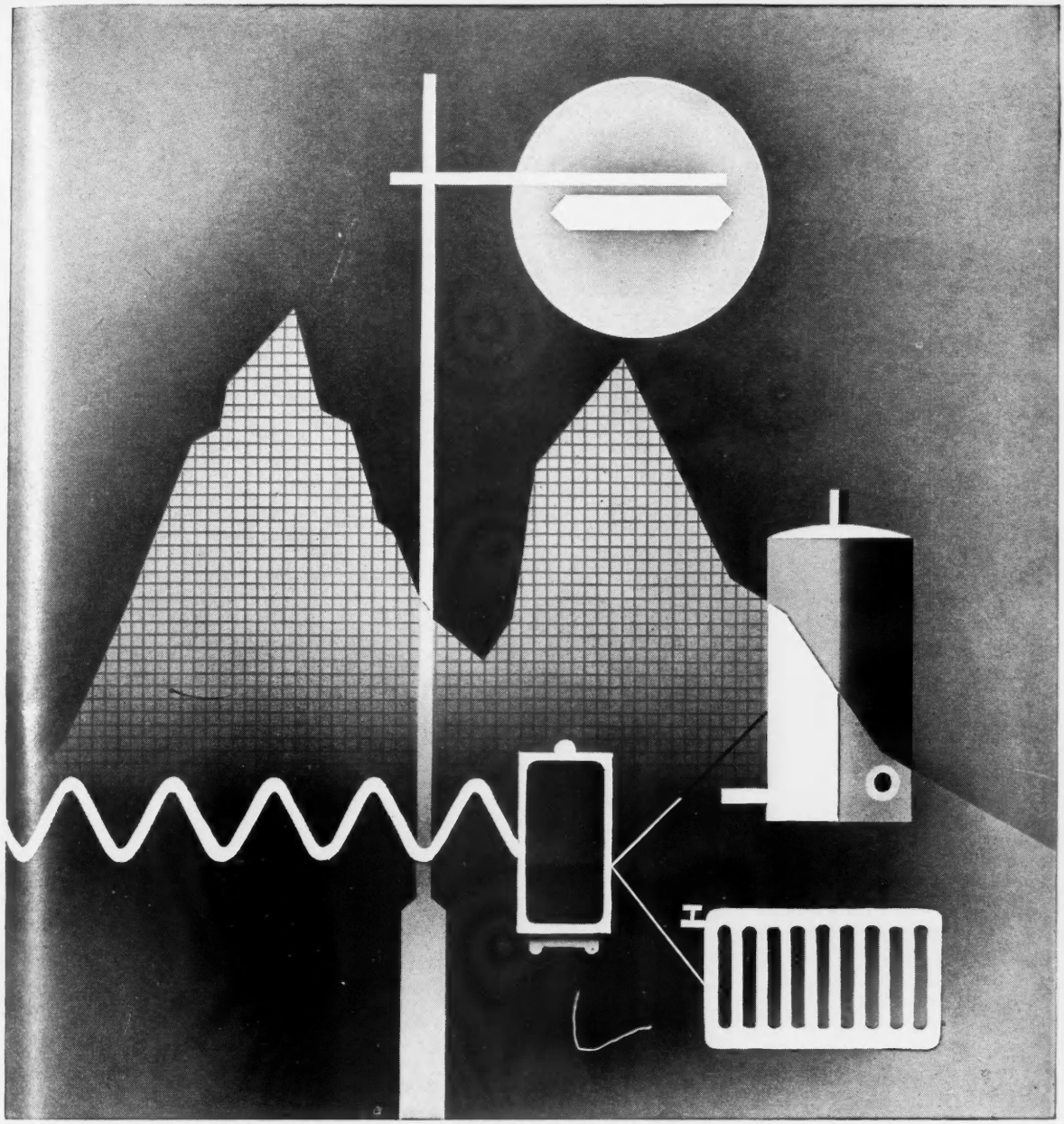

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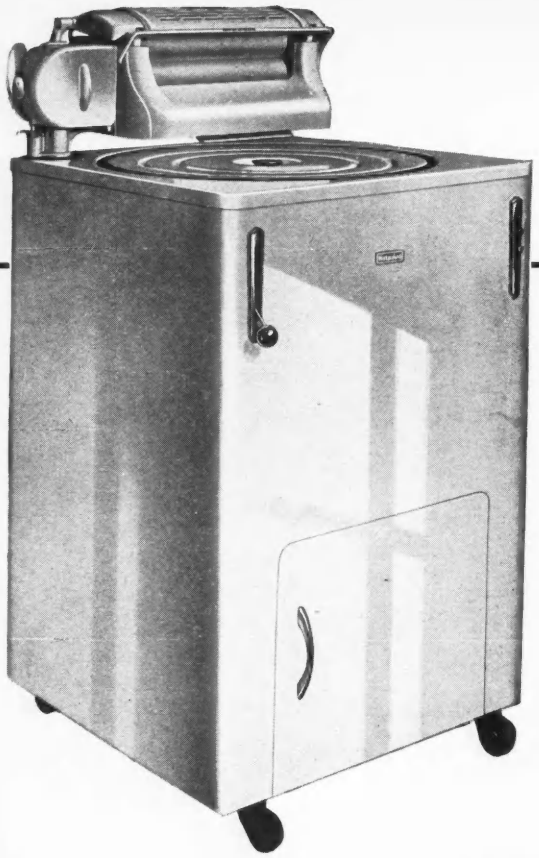

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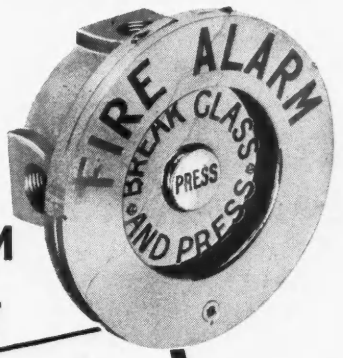

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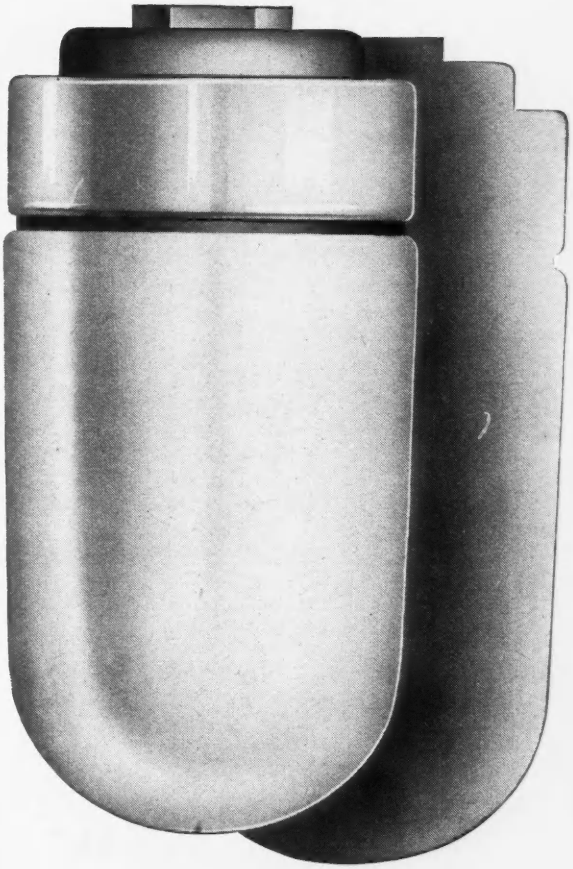

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Patent No. 568702

Issued by Rowlands Electrical Accessories Ltd., R.E.A.L. Works, Birmingham 18

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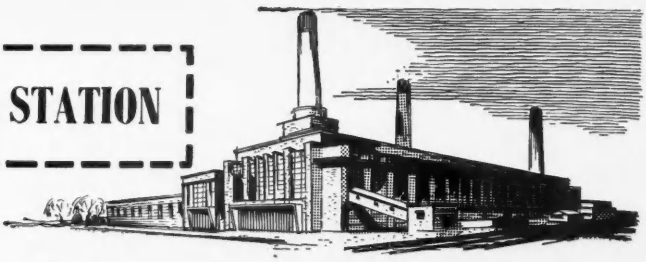

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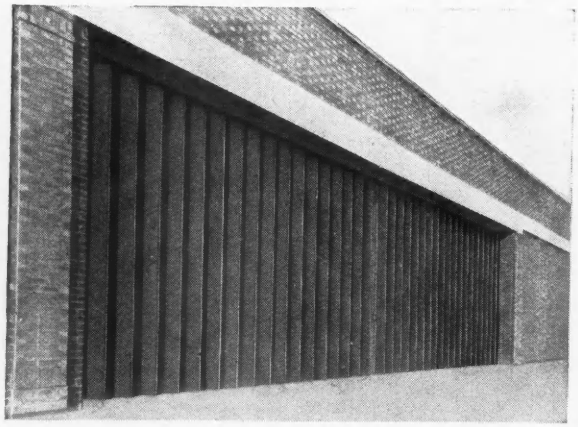

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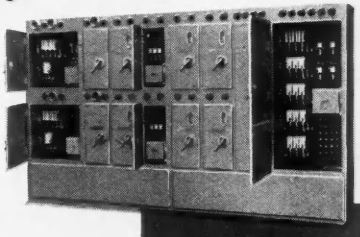

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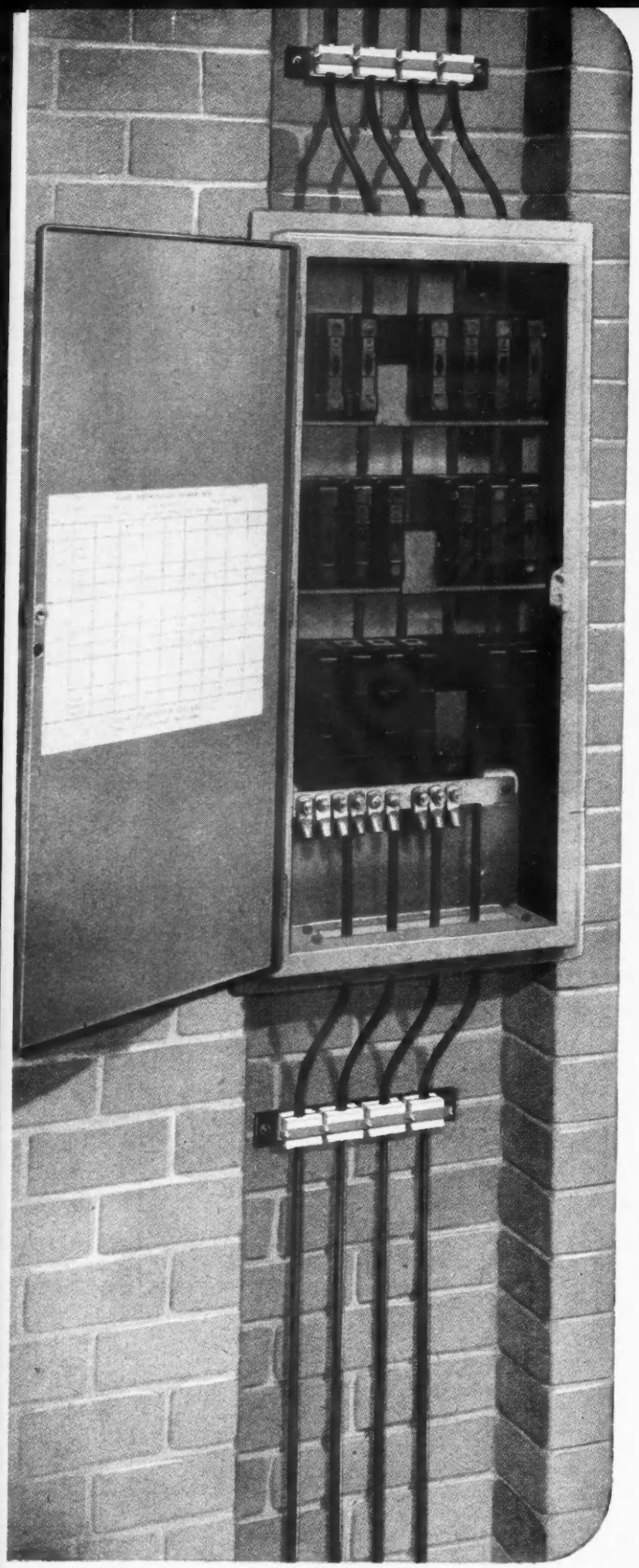

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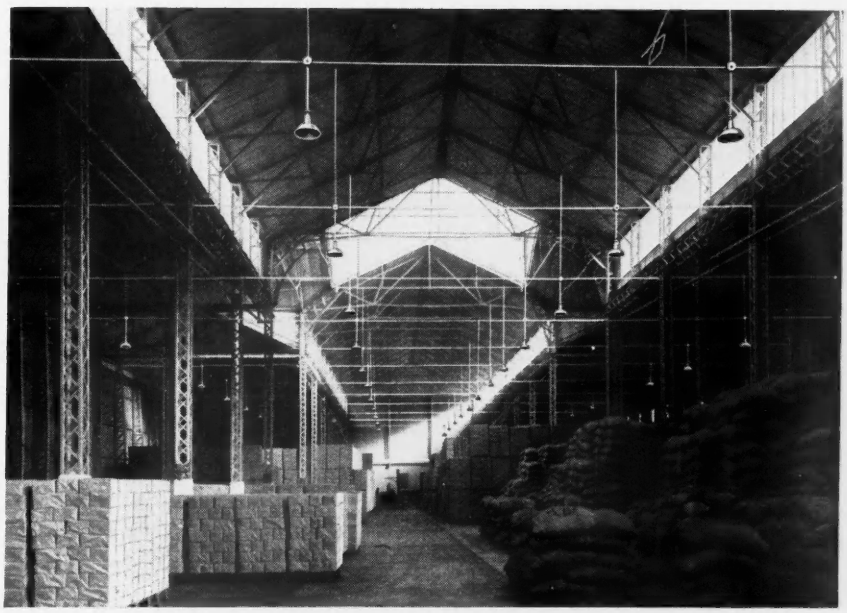

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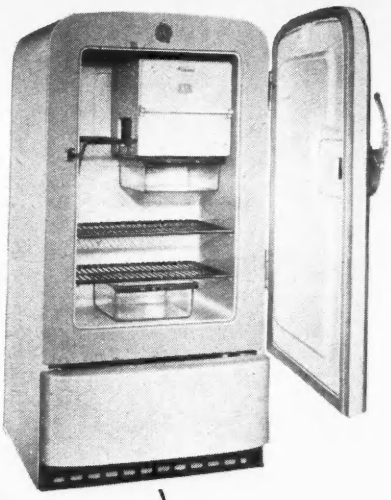

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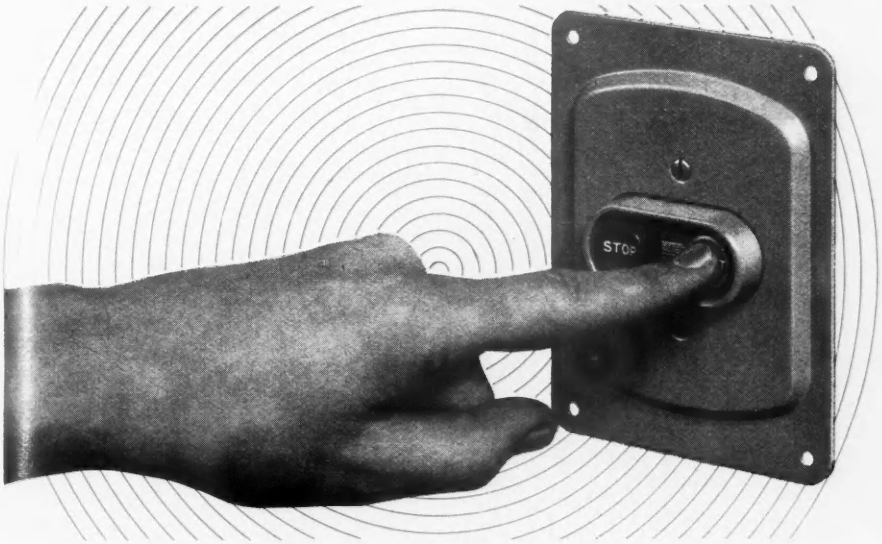
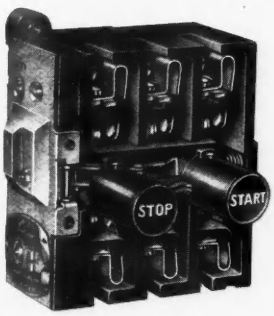
COMPLETE 'FREE HANDLE' CONTROL



THE Type D-6 starter cannot be held closed against an overload. A "free handle" mechanism disengages the control buttons immediately the overload release has opened the circuit. It is therefore impossible to close the contacts by holding in the start button—a feature which ends any irresponsible running of an overloaded motor.

After cooling, the motor will not automatically restart. The stop button has to be depressed to reset the "free handle" control before the start button can operate. This double safety measure—for operator and motor—is only one of the many features of the Crabtree D-6 starter.



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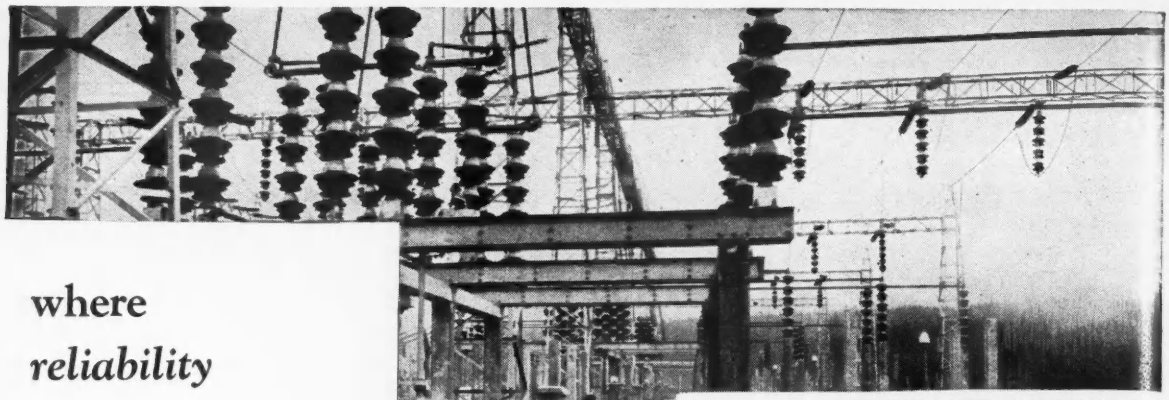

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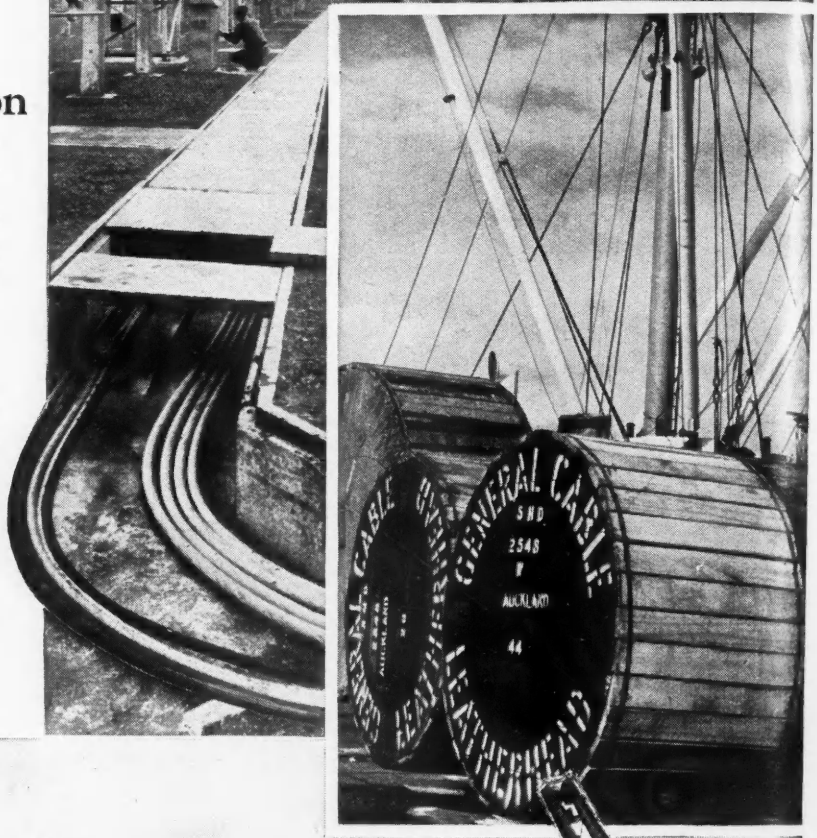

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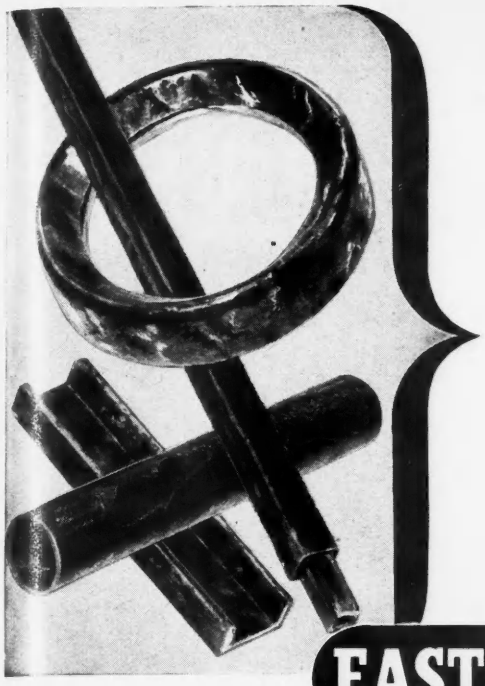

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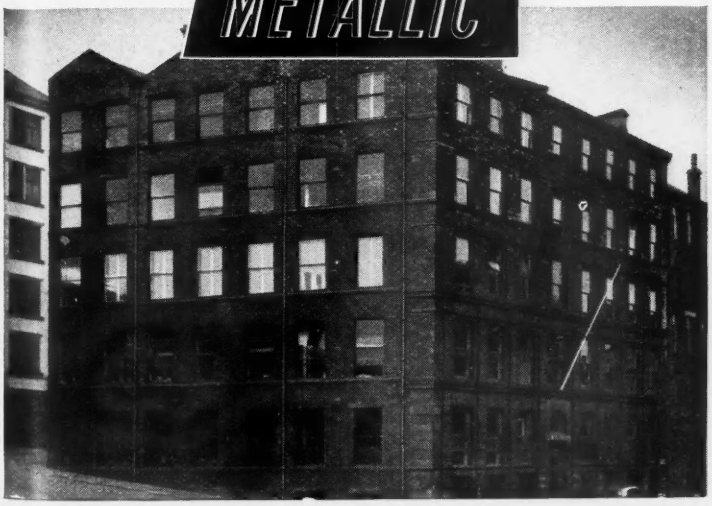

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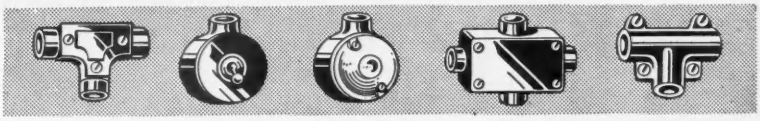

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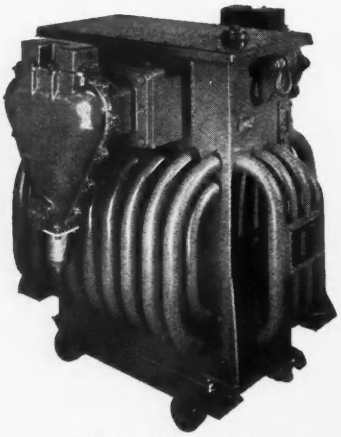

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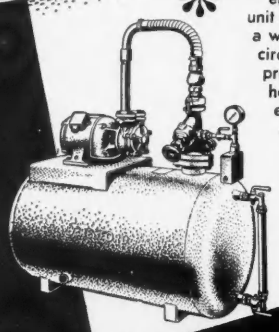

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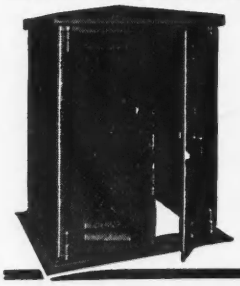

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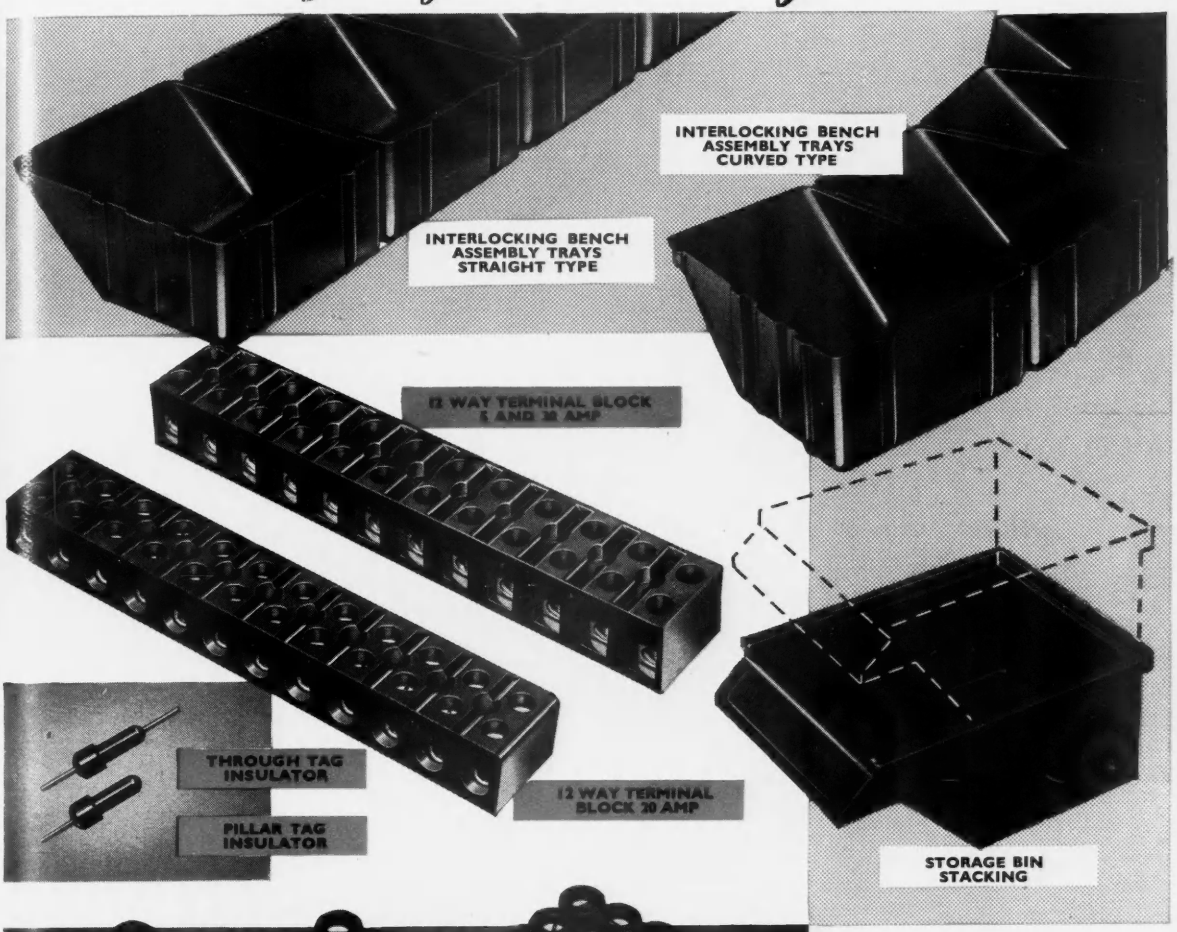
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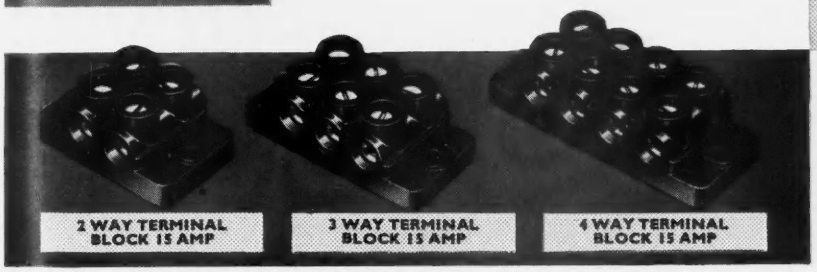

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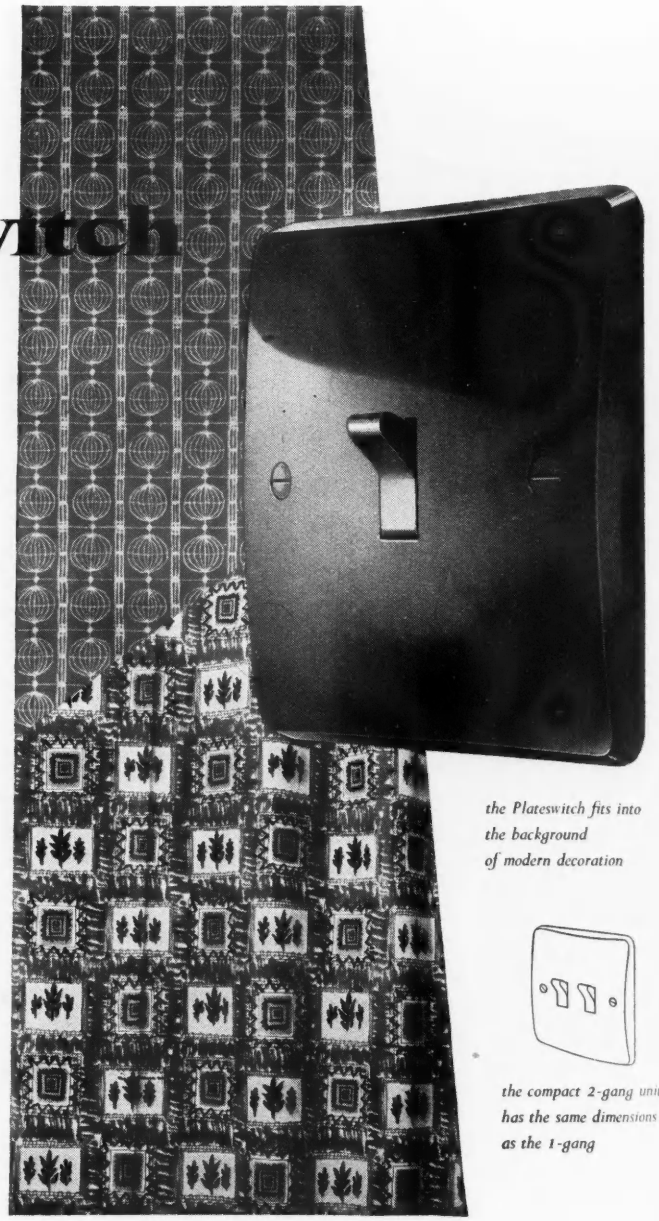

the Plateswitch fits into the background of modern decoration

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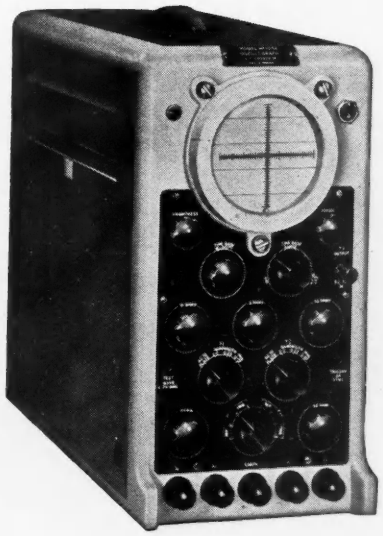

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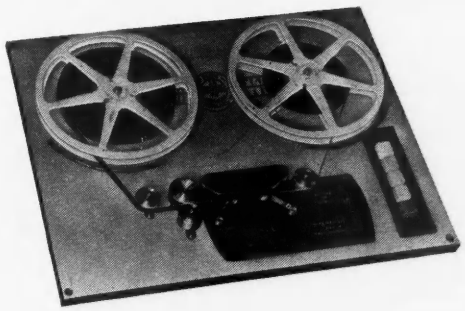
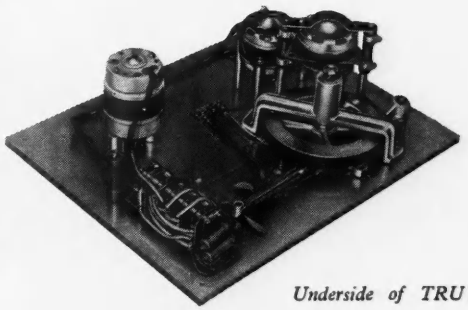
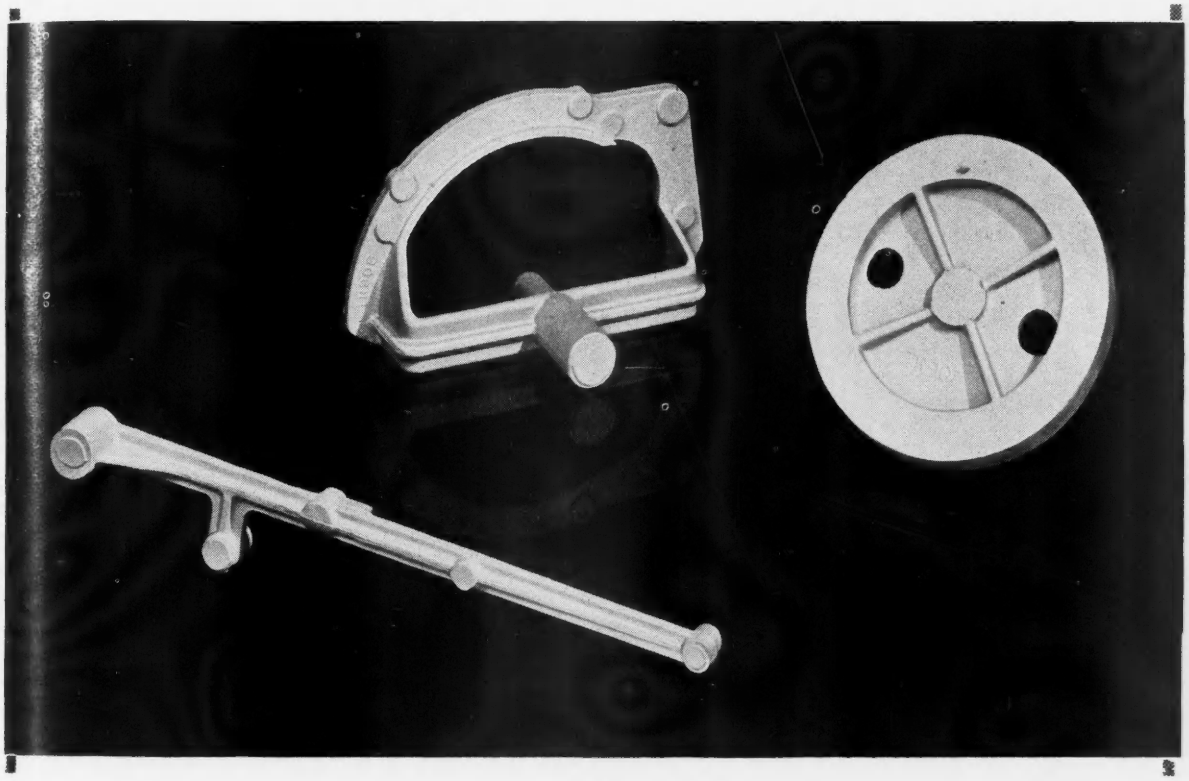


TRUVOX Tape Deck Mark III.



Underside of TRUVOX Tape Deck Mark III.

Below: Aluminium Alloy Castings for flywheel, flywheeel cradle and tape release lever.



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Announce a new range of

FRACTIONAL HORSE POWER MOTORS

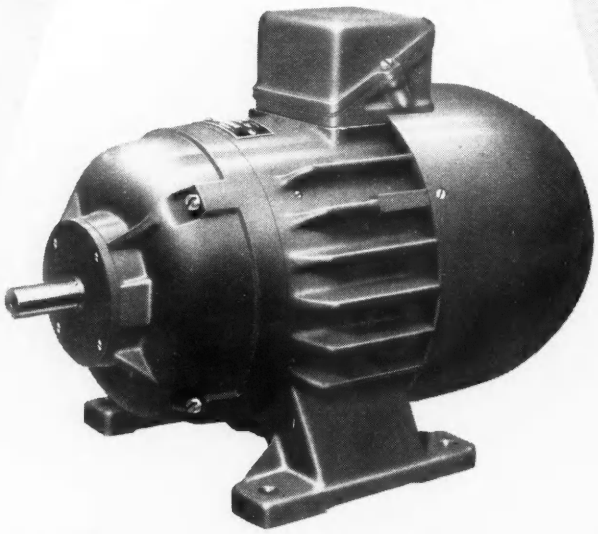
30 Years of design experience have gone into the development of this new range of Fractional Horse Power Induction Motors. The main physical dimensions of earlier frames have been maintained, but H.P. outputs have been increased.

We are specialists also in the following types of Fractional Horse Power machines:

Synchronous	**Rotary Converters**
Shaded Pole	**Rotary Transformers**
High Frequency	**Motor Alternator Sets**
A.C. & D.C. Commutator	**Motor Generators**
Aircraft	**Geared Motor Units**

Two Speed Synchronous Hysteresis

We will be glad to furnish details on request.



P. FRAME totally enclosed externally cooled A.C. ratings up to 2½ H.P.
X. FRAME totally enclosed externally cooled D.C. ratings up to 1 H.P. and generators up to 600 V.A. capacity.

CROYDON ENGINEERING CO., LTD.

COMMERCE WAY PURLEY WAY CROYDON

Telephone: CROYDON 4125/6/7/8. *Telegrams:* SYNCROY, CROYDON.

Better Quality PRODUCTION

is the natural result of using "B-W" Industrial Heating Equipment. Shown here are only two examples of smaller devices included in the wide range of "B-W" Aids to Production. Write for full details to-day

"B-W" STANDARD PRODUCTS INCLUDE:

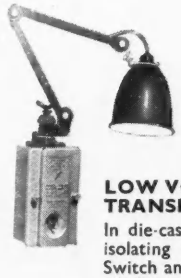
- OVENS
- FURNACES
- DIP TANKS
- WAX POTS
- TINNING BATHS
- DRYING PLANTS
- SALT BATHS
- LEAD POTS
- GLUE POTS
- VACUUM PLANTS

and
SPECIAL EQUIPMENT TO REQUIREMENTS

INDUSTRY NEEDS HEAT—YOU NEED "B-W"

Barlow-Whitney

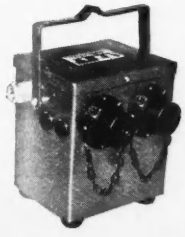
All enquiries to SALES OFFICE:
2 DORSET SQUARE, LONDON, N.W.1. **AMBassador 5485**
Works: **NEASDEN and BLETCHLEY**



Electrical EQUIPMENT

LOW VOLTAGE LIGHTING TRANSFORMER
In die-cast Aluminium Case, Self-isolating fitted with D.P. on-off Switch and H.R.C. Fuses to B.S.S. 794/38. Can be supplied with 1, 2 or 3 arm Lighting Brackets or Low Voltage Plugs and Sockets.

MEDIUM VOLTAGE ALL INSULATED TEST LAMP
100 — 500 Volts. A.C. D.C. Fitted with H.R.C. Fuses in each prod.



PORTABLE TRANSFORMERS
For portable m/c tools, handlamps, etc., Secondary Voltages from 12 V — 110 Volts. Capacities from 50 V.A. to 750 V.A.

LOOPMETERS
For testing earth fault loop resistance —2 models available.

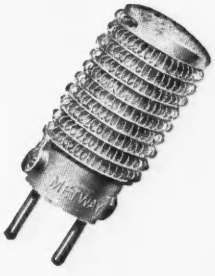
JOHN DRUMMOND (ENGINEERS) LTD.
23 LOCHBURN ROAD · MARYHILL · GLASGOW N.W.
Telephone: Maryhill 1893

METWAY PRODUCTS
Registered Trade Mark

ORDER NOW FOR THE COMING SEASON

Elements and Spirals

FIRE BARS & TUBULARS ★



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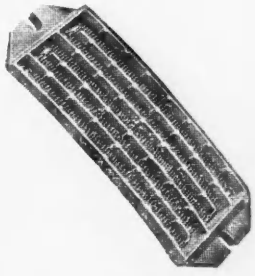

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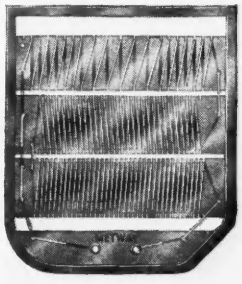

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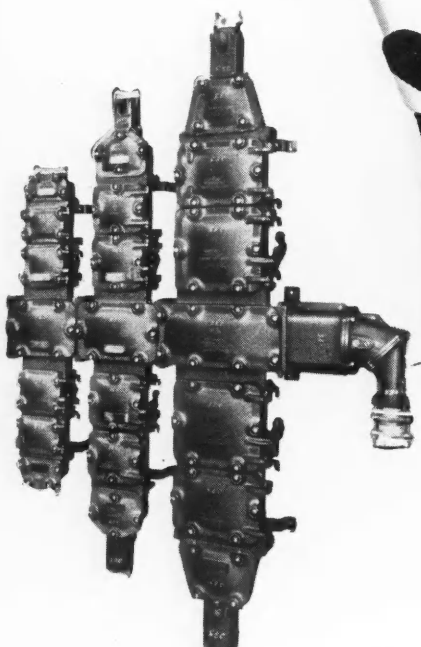
IF YOU DO NOT POSSESS OUR CATALOGUE ASK FOR
No. MYK/2/ER

METWAY ELECTRICAL INDUSTRIES LTD.
KING STREET, BRIGHTON 1, SUSSEX
Telephone: Brighton 28366 (7 lines) *Telegrams: Metway, Brighton*

Information you can't afford to miss!



G.E.C. FLAMEPROOF SWITCH FUSES

Information you can't afford to miss is contained in Switchgear Bulletin X2497. Send for your copy now.

G.E.C. Flameproof Switch Fuses for use in situations where flameproof enclosures are necessary, fully comply with BS229/1946 (Flameproof enclosures of electrical apparatus) and BS861 (Air-break switches). Certified by the Ministry of Fuel and Power for use in gases in Groups 1, 2 and 3.

THE GENERAL ELECTRIC CO. LTD · MAGNET HOUSE · KINGSWAY · LONDON · W.C.2

G.E.C.

CLASSIFIED ADVERTISEMENTS

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue (*see Notice below for 30th July and 6th August issues*) and should be addressed to Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

CLASSIFIED advertisements are **PREPAID** at 3/- per line (approx. 6 words) per insertion. Where an advertisement includes a **Box Number** this counts as two words and carries an additional charge of 1/-.

DISPLAYED:—£2 per inch, per insertion. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

Original testimonials should not be sent with applications for employment

30th JULY ISSUE

Classified Advertisements for the above issue have now closed for press.

6th AUGUST ISSUE

Classified Advertisements for the above issue are accepted up to first post on FRIDAY, July 30th

OFFICIAL NOTICES, TENDERS, ETC.

CITY OF BELFAST

Electricity Department

TENDERS are invited for Replating Cells of Storage Battery at East Bridge Street Station.

Form of tender and Specification (No. W.43) may be obtained at the Electricity Department, East Bridge Street, Belfast, on payment of a deposit of one guinea, which will be refunded provided a bona fide tender is lodged and not withdrawn. Extra copies may be obtained at half guinea each; this sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department.

Each tender, in sealed envelope marked "Tenders for Replating Cells of Storage Battery, Electricity Committee," and endorsed with the name and address of the tenderer, must reach the undersigned not later than 4 p.m. on Friday, 13th August, 1954.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

City Hall, Belfast.
15th July, 1954. 4251

LEEDS REGIONAL HOSPITAL BOARD

To Electrical Contractors

TENDERS are invited for carrying out the Electrical Installations in the two new single-storey villas to be erected at Scalebor Park Hospital, Burley-in-Wharfedale.

Applications for form of tender and specification and drawings, accompanied by a deposit of £2 2s. (which will be refunded on receipt of a bona fide tender and other contract documents), must be made to the Architect to the Board at the undermentioned address not later than 12 noon on Wednesday, 28th July, 1954. Cheques should be made payable to the "Leeds Regional Hospital Board" and crossed.

A copy of the drawings, conditions of tender and conditions of contract may be inspected at the office of the Architect to the Board.

Sealed tenders, in the endorsed envelope provided, must be delivered to the undersigned not later than 12 noon on Monday, 30th August, 1954.

The Board does not bind itself to accept the lowest or any tender.

WM. A. SHEE,
Secretary to the Board.

Park Parade,
Harrogate. 4111

BOROUGH OF ROMFORD

Street Lighting Conversion

TENDERS are invited for the supply and/or erection of 10 Sodium Vapour Class A and 369 Class B reinforced concrete lighting columns and lanterns.

Conditions of contract, etc., should be obtained from the Borough Engineer at the Town Hall, Romford, on deposit of a cheque for two guineas.

Tenders are to be delivered to J. Twinn, Town Clerk, at the Town Hall, Romford, by Wednesday, 11th August, 1954. 4294

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Garry Project

Electric Lighting, Heating and other Subsidiary Services for Quoich Power Station

TENDERS are invited for the above installation. Copies of the tender document may be obtained on application, with cheque for two guineas (returnable), to the Engineers, Messrs. Kennedy & Donkin, 12, Caxton Street, London, S.W.1.

The Board do not bind themselves to accept the lowest or any tender.

W. D. D. FENTON,
Secretary.

16, Rothesay Terrace,
Edinburgh, 3.
15th July, 1954. 4252

METROPOLITAN BOROUGH OF WANDSWORTH

Repair of Time Switches

TENDERS are invited for the repair of approximately 700 Synchronous Solar Dial Electric Time Switches.

Tender form, etc., obtainable from the Borough Engineer, must be returned to me by noon, Wednesday, 25th August, 1954.

R. H. JERMAN,
Town Clerk.

Municipal Buildings,
Wandsworth,
London, S.W.18. 4197

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the Local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order, 1952.

POWER STATION ELECTRICAL AND MECHANICAL ENGINEER

required for service with the SUDAN LIGHT & POWER CO. LTD., in KHARTOUM, SUDAN, as DEPUTY POWER STATION SUPERINTENDENT. Basic salary on appointment within the range £E.1,500-£E.2,000 per annum according to qualifications and experience. (£E.1 = £1 0s. 6d.)

Candidates should be between the age of 30 and 45 years, and have had not less than 10 years' experience in the construction and operation of modern power stations equipped with boilers and turbine alternator sets operating at not less than 400 p.s.i.g. and 750° F., and E.H.T. switchgear and associated control equipment. Experience with oil-fired boilers and also diesel alternators up to 1,200 kW of value. Evidence should be produced of having held positions of responsibility requiring organizing and administrative ability. Initially duties will include the supervision of erection and commissioning of a steam power station equipped with two 5-MW steam turbine alternator sets.

Appointment will be on contract by arrangement up to 10 years, including a period of 12 months' probation, with a bonus payable on completion of the contractual period. Free living accommodation with basic furniture or an allowance in lieu thereof will be provided. After satisfactory completion of the probationary period liberal leave on full salary with free passages. In addition to basic salary a cost-of-living allowance will be payable; and a kit allowance of £E.50 on appointment.

Applications, stating age, education, qualifications, experience (with particulars of posts held), present appointment and salary, with names of two references, should be submitted to the Secretary, The Power & Traction Finance Company Limited, Queens House, Kingsway, London, W.C.2. 4140

YORKSHIRE ELECTRICITY BOARD

No. 5 (Wakefield) Sub-Area

BARNSLEY DISTRICT

SECOND ASSISTANT DISTRICT ENGINEER. Applicants should be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications. They must have had a sound practical training and extensive experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and ancillary equipment, preferably in a large undertaking.

Salary N.J.B. Class F, Grade 7, £697/£718 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a, Denby Dale Road, Wakefield, not later than 5th August, 1954.

No. 6 (Hull) Sub-Area

BRIDLINGTON & GOOLE DISTRICTS

THIRD ASSISTANT DISTRICT ENGINEERS (Commercial). Applicants should have had a sound practical training in electrical installation work and have an up-to-date knowledge of the utilisation of electrical appliances on farms. The successful applicants will be required to negotiate with consumers requiring electricity supplies, particularly in rural areas, and deal with estimates for installations, tariffs and sales development generally.

Candidates should be in possession of the Higher National Certificate in Electrical Engineering, or similar qualification.

The successful applicants will be required to reside in the District to which they are appointed.

Salary:—

Bridlington District: N.J.B. Class D, Grade 9, £561/£578 per annum.

Goole District: N.J.B. Class E, Grade 9, £587/£600 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 5th August, 1954. 4238

APPLICATION ENGINEERING

APPOINTMENTS are available with THE ENGLISH ELECTRIC COMPANY LIMITED on important work covering Application Engineering on all classes of electrical equipment. These appointments are pensionable after a qualifying period, and apprentice-trained men with Higher National Certificate in Electrical or Mechanical Engineering or equivalent and with previous experience on application work are preferred.

Experience in the manufacturing or power supply industries or in the application or installation of electrical equipment in any branch of industry or engineering is an alternative qualification and professional engineers in these fields are also invited to apply.

A number of vacancies also exist for apprentice-trained engineers seeking an opportunity of acquiring Application Engineering experience. Reply stating age, experience, qualifications, and quoting Ref. S.A.33C, to Dept. C.P.S., 336/7, Strand, London, W.C.2.

4093

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the following positions within the Division:—

ASSISTANT SHIFT CHARGE ENGINEERS, DRAKELOW POWER STATION (Vacancy No. 102/54/ER). Applicants must have technical qualifications up to H.N.C. standard and have received a sound engineering training followed by operating experience with large capacity high-pressure plant, preferably in conjunction with p.f. boilers.

Salary for this appointment will be within Class J, Grade 9 (£719-£750 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 26th July, 1954.

ASSISTANT ENGINEER (COAL AND ASH PLANT), DRAKELOW POWER STATION (Vacancy No. 103/54/ER). Applicants must have wide experience of operation and maintenance at a large power station employing p.f. boiler plant.

Candidates should have suitable technical qualifications admitting to Corporate Membership of the Institution of Mechanical Engineers and/or the Institution of Electrical Engineers.

The successful applicant will be responsible to the Station Superintendent for the programming of coal traffic and for the operation of the coal and ash plants.

Salary for this appointment will be within Class J, Grade 8 (£764-£796 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 26th July, 1954.

DRAUGHTSMEN, TRANSMISSION DEPT., DIVISIONAL HEADQUARTERS (Vacancy No. 105/54/ER). Draughtsmen are required in the Transmission Department at this Divisional Headquarters. Experience on the design and construction of H.V. substations or overhead transmission lines an advantage.

Salary, according to experience and ability, within Grade 6 (£433-£567 per annum) or Grade 5 (£567-£671 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications, 26th July, 1954.

SHIFT CONTROL ENGINEER, WARWICK POWER STATION (Vacancy No. 107/54/ER). Applicants should have had some experience in power station control and have O.N.C. in Electricity.

Salary for this appointment will be within Class E, Grade 10 (£555-£569 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5th August, 1954.

JUNIOR ENGINEERS, STAYTHORPE POWER STATION (Vacancy No. 108/54/ER). Junior Engineers are required at Staythorpe Power Station, where suitable young engineers will be given opportunity to obtain operating and maintenance experience in the various sections of this large generating station operating at 900°/900 lb. sq. in. steam conditions.

Salary for this appointment will be within Class J, between Grades 17 and 14 (£424-£545 per annum), of the National Joint Board Agreement, according to qualifications and experience.

Preference will be given to candidates who hold the Higher National Certificate, or who are at present pursuing a course of study with the object of obtaining this or a similar qualification.

Closing date for receipt of applications, 5th August, 1954.

These appointments will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller.

16th July, 1954. 4263

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:—

CHILTERNS SUB-AREA HEADQUARTERS
(84/54.R.)

2ND ASSISTANT ENGINEER (PLANNING AND DEVELOPMENT). Candidates should have had a wide experience in the design, layout and operation of urban and rural distribution systems comprising overhead and underground networks (including substations) at voltages up to and including 33kV. They should be experienced in the preparation of distribution schemes including the technical design, specification and estimates. Corporate Membership of the Institution of Electrical Engineers or the possession of a degree in electrical engineering will be an advantage.

Salary in accordance with Class L, Grade 7 of the National Joint Board Salary Agreement, commencing at £926.

Apply to the Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend Street, Bedford.

NORTHMET SUB-AREA HEADQUARTERS
(98/54.R.)

JUNIOR ENGINEER. Candidates should have had a good general and technical education and possess the Higher National Certificate or equivalent qualifications. Previous experience in a planning and development office will be an advantage.

Salary in accordance with Class N, Grades 22-18, of the National Joint Board Salary Agreement within a range of £402-£544, plus London allowance, commencing at a point dependent upon qualifications and experience.

Apply to the Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet House, Southgate, London, N.14

NORTHMET SUB-AREA
ENFIELD DISTRICT
(97/54.R.)

JUNIOR ENGINEER. Candidates should have had a good general and technical education and the possession of the Higher National Certificate of Electrical Engineering would be an advantage.

Salary in accordance with Class F, Grade 15 of the National Joint Board Salary Agreement, commencing at £402, plus London allowance.

Apply to the District Manager, Enfield, Eastern Electricity Board, 40, Church Street, Enfield, Middlesex.

CHILTERNS SUB-AREA
LUTON DISTRICT
(99/54.R.)

(a) 3RD ASSISTANT ENGINEER. (b) 2 GENERAL ASSISTANT ENGINEERS. Candidates should have had a sound technical training and experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground systems.

(a) Salary in accordance with Class G, Grade 9 of the National Joint Board Salary Agreement, commencing at £641.

(b) Salary in accordance with Class G, Grade 11 of the National Joint Salary Board Agreement, commencing at £573.

Apply to the District Manager, Luton, Eastern Electricity Board, 487, Dunstable Road, Luton.

Future salaries and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications by letter, stating age, education, qualifications and experience with details of present appointment, should be submitted to the Managers concerned within 14 days of the appearance of this advertisement. 4257

BRITISH ELECTRICITY AUTHORITY

North West, Merseyside and North Wales Division

VACANCY No. 123/54: DEPUTY POWER STATION SUPERINTENDENT, Stockport Generating Station. Salary £912/£951 (F.3).

Vacancy No. 124/54: DEPUTY POWER STATION SUPERINTENDENT, Huncoat Generating Station, near Accrington. Salary £912/£951 (F.3).

Apply, quoting vacancy number, to Controller, British Electricity House, 825, Wilmslow Road, Manchester, 20, before 31st July, 1954. 4234

THE MULLARD RADIO VALVE CO. LTD.

has STAFF VACANCIES in its VALVE MEASUREMENT AND APPLICATIONS LABORATORY. This department is concerned with the uses of thermionic devices of all kinds rather than with their manufacture. It provides information to the valve user, the development departments, and to the manufacturing departments. For these purposes it carries out dynamic measurements and conducts circuit investigations connected with new applications. It also undertakes the design of some of the more specialised test equipment required for these investigations.

Due to expansion in this department, applications are invited from ELECTRONIC ENGINEERS and PHYSICISTS for posts concerned with the following fields of specialised work:

REF. W.11 (1) Gas or mercury vapour thyratrons and rectifiers.

REF. W.12 (2) Ultra high frequence valves such as magnetrons, klystrons and travelling wave tubes.

REF. W.13 (3) Transmitting valves for communications and general industrial uses.

REF. W.14 (4) Pulse techniques associated with U.H.F. devices and thyratrons.

REF. W.15 (5) Receiving valves used for frequencies between 100 and 1,000/M/C/s.

REF. W.16 (6) Valves and semi-conductors used in computing and switching apparatus.

Applicants for any of the above posts should possess a university degree or equivalent qualification, and previous experience in similar work, although not essential, is considered an advantage.

In addition to the above posts there are a number of less senior posts available for applicants who possess advanced level G.C.E. in science subjects or equivalent qualifications or who are at present pursuing courses leading to H.N.C. or external degrees. Such applicants should quote Ref. W.17.

The vacancies outlined are at or near the company's Mitcham factory. Salaries will be according to individual age, experience and qualifications and can be considered as progressive. Company policy regarding the employment of scientific staff provides adequate prospects for advancement, and breadth of outlook is assured by opportunities of transfer to other fields of work within the company's activities. There are facilities for further training and a company pension scheme.

Applications in writing, which will be treated with the strictest confidence, should be addressed to the Personnel Officer, The Mullard Radio Valve Co. Ltd., New Road, Mitcham Junction, Surrey, quoting the appropriate reference number.

4198

MIDLANDS ELECTRICITY BOARD

SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER required in the Stone District of the North Staffs Sub-Area.

Applicants should have had a sound technical training and experience in the preparation of wiring schemes and estimates for domestic, farm and industrial installations. Duties will include advice to consumers on supply matters and sales of domestic and farm equipment. Technical qualifications desirable. Salary £592/£610 per annum (N.J.B., D.8). Superannuable.

Apply in writing within 10 days, stating age, experience, etc., to District Manager, Midlands Electricity Board, High Street, Stone, Staffs.

A. STEPHENS, Secretary.

4261

RESEARCH AND DEVELOPMENT

THE J. STONE GROUP OF COMPANIES which has extensive and expanding interests in electrical and mechanical engineering offers PERMANENT POSITIONS on its RESEARCH AND DEVELOPMENT STAFF to:—

(a) DESIGN AND LABORATORY ASSISTANTS for development of light electrical and mechanical equipment, with prospects of advancement later to technical or sales staff overseas. Previous design experience not essential, but applicants should be of degree standard, and have had works experience.

(b) SENIOR DRAUGHTSMEN dealing with light mechanical and electrical equipment, especially dynamo-electrical machinery, automatic control gear, and mechanical drives. Works experience essential. O.N.C. or H.N.C. preferred.

Applications in first instance to PERSONNEL MANAGER, J. STONE AND CO. (DEPTFORD) LTD., ARKLOW ROAD, LONDON, S.E.14, giving full details training, etc.

4012

BRITISH ELECTRICITY AUTHORITY

South East Scotland Division

SENIOR DRAUGHTSMAN (Mechanical) required for Generation (Construction) Dept., Divisional Headquarters, Portobello.

Applicants should preferably have experience in the general layout of steam power stations, ships or heavy engineering plant in a contractor's drawing office. A good general and technical education, preferably to Higher National Certificate standard, is required.

Salary within scale £567-£671 p.a. (N.J.B. Schedule D, Grade 5). Pension scheme.

Applications, stating age and experience, to be submitted by 31st July, 1954, to Divisional Controller, British Electricity Authority, South East Scotland Division, British Electricity House, Portobello, Midlothian. 4223

SOUTH EAST SCOTLAND ELECTRICITY BOARD

Edinburgh Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER, N.J.B. Grade F.7. Salary £697-£718 per annum.

Applicants should have had wide experience in the operation and maintenance of underground distribution systems up to 33 kV.

Applications stating age, qualifications (which should be not less than H.N.C. or equivalent), training, experience and present position, should be received by the undersigned within 14 days.

G. T. ALLCOCK,
Sub-Area Manager.

Dewar Place,
Edinburgh, 3.
10th July, 1954. 4207

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or C. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for posts (a) and Corporate Membership for post (b) an advantage.

(a) GENERAL ASSISTANT ENGINEERS (EFFICIENCY & TESTING), DIVISIONAL & GROUP 2 HEADQUARTERS (Vacancy No. 54/586). Good technical education necessary, with experience of the testing and/or operation of the mechanical plant in power station. Salary Class AX/EX, Grade 8 = £526 1s. to £749 14s. p.a.

(b) THIRD ASSISTANT ENGINEER (COMMUNICATIONS SECTION), TECHNICAL DEPT., DIVISIONAL HEADQUARTERS (Vac. No. 54/587). Successful candidate will be based at Westminster, London, S.W.1. The section is responsible for the construction, testing and maintenance of a private communications system owned and maintained by the Authority, using line, teleprinter and radio equipment and techniques. Previous experience on this class of apparatus is essential, and telephone manufacturer's works experience is desirable. The engineer appointed will be directly responsible to the Communications Engineer and deputise for him in his absence. Preference will be given to candidates educated to university degree standard, preferably in physics or light current electrical engineering, and with administrative experience. Commencing salary in range £801 3s./£943 19s., with ultimate progression to £1,053 in accordance with Class AX/EX, Grade 4.

(a) ASSISTANT ENGINEER (EFFICIENCY & TESTING), FULHAM GENERATING STATION (Vacancy No. 54/588). Knowledge of thermodynamics and combustion necessary. Salary Class L, Grade 11 = £752 17s. p.a.

(a) JUNIOR ENGINEERS (Vacancy No. 54/560). Junior engineers required at various power stations in the London Area. Excellent opportunities for training and promotion to higher grades. Salary and conditions of service in accordance with N.J.B. Agreement.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, Generation House, Great Portland Street, London, W.1, and be received within 14 days of this advertisement. 4249

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Third Assistant Engineer (Transmission)

APPLICATIONS are invited for the above post on the staff of the Chief Electrical and Mechanical Engineer at the Board's Head Office. Applicants should have technical education up to at least Higher National Certificate standard and should have constructional or operational experience of 132/33-kV substations and overhead lines.

Salary commencing at a point within the range £763-£899 (N.J.B. Schedule C, Class AX, Grade 4), depending on experience and qualifications. Superannuation scheme applicable.

Application form, obtainable from Secretary, 16, Rothesay Terrace, Edinburgh, 3, should be returned within 14 days of the appearance of this advertisement. 4221

BRITISH ELECTRICITY AUTHORITY

Midlands Division

SHIFT CHARGE ENGINEER is required at Birchills Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade D7, commencing at £633 per annum.

A sound technical training and practical experience in the control and operation of steam generating plant and main switchgear are required. Appropriate qualifications an advantage.

Apply, quoting Vacancy No. 717MD, on form AE6, available from the Establishments Officer, 53, Wake Green Rd., Moseley, Birmingham, 13, by 7th August, 1954. 4253

JOHNSON & PHILLIPS LIMITED

Staff for South Africa

JOHNSON & PHILLIPS Limited require the following Staff for their South African Branch:—

1. CHIEF DRAUGHTSMAN. Candidates must have good technical and practical qualifications, in addition to experience with leading switchgear manufacturers both in design and contract work.
2. SENIOR SWITCHGEAR DRAUGHTSMAN. Candidates must have good technical and practical training, in addition to experience with leading switchgear manufacturers. Some experience in switchgear design is essential.
3. TECHNICAL SALES ENGINEER. Candidates should have a technical background, preferably not less than Higher National Certificate level, and experience in preparing tenders for switchgear up to 33,000 volts.
4. TECHNICAL SALES PROMOTION ENGINEER. Candidates should have a sound technical background, a pleasing personality, and experience of outside representation among buyers and consultants. Successful candidate will operate from Johannesburg, but may be expected to travel in the Northern part of the Union of South Africa, although most of his contacts will be in and around Johannesburg.

These appointments are for permanent situations at the J. & P. Switchgear Works at Driehoek, Johannesburg, where switchgear up to 11,000 volts is manufactured and enquiries for gear up to 66,000 volts are handled. In all cases preference will be given to men between 28 and 38 years of age. Salaries will be in accordance with qualifications and experience, and good bonus and life assurance schemes are in force. Applicants should clearly state for which post they are applying and state age, experience and salary required.

Applications should be addressed to the Employment & Welfare Manager, Johnson & Phillips Ltd., Charlton, London, S.E.7. 4237

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the following posts:—

THIRD ASSISTANT ENGINEER (MECHANICAL), CONSTRUCTION DEPARTMENT, MARCHWOOD GENERATING STATION SITE (S.13.552). Duties will be mainly concerned with the supervision of erection and commissioning of turbines, alternators, and auxiliary plant. Manufacturing works experience and practical experience in the mechanical aspects of generating station design or construction are desirable, and practical experience in plant erection will be an advantage. Applicants should preferably be corporate members of a recognised professional institution or hold qualifications leading to corporate membership.

Salary N.J.B., Grade 5, AX/CX, £649-£835.

BOILER HOUSE SHIFT CHARGE ENGINEER, SOUTHAMPTON GENERATING STATION (S/13.553). Applicants should have had a sound mechanical training and experience in the design and operation of high-pressure boiler plant, and should preferably possess technical qualifications admitting to corporate membership of a recognised professional institution.

Salary N.J.B., Grade F/9, £607-£629.

ENGINEER (GRADE 10), POOLE GENERATING STATION (S/13.554). The successful candidate may be called upon to perform the duties of a Station Shift Control Engineer, to assist on maintenance work, or to perform general station duties. Operating experience of modern generating station plant is essential.

Applicants should have had a sound technical training and should possess qualifications leading to corporate membership of an appropriate professional institution.

Salary N.J.B., H/10, £641/£667.

Special application forms, obtainable from P. D. A. Oliver, Divisional Secretary, 111, High St., Portsmouth, should be returned by 6th August, 1954. 4258

BRITISH ELECTRICITY AUTHORITY

London Division

ELECTRICAL ENGINEER (Construction) required in the Chief Generation Engineer's (Construction) Department.

Candidates should preferably be Corporate Members of the Institution of Electrical and/or Mechanical Engineers and have a detailed knowledge and wide experience of generating station electrical plant design, arrangement and construction. Experience in the operation and testing of modern plant is essential.

The successful candidate will be responsible for the technical supervision of electrical plant contracts for stations in the Division, including preparation of schemes and designs, specifications, analysis of tenders, etc., and technical supervision during site erection and testing.

Candidates should have held a similar position of responsibility in the industry and be capable of administering the electrical section.

Salary provisionally within N.J.M. Scale 4, £1,650-£1,800 inclusive.

Applications stating age, present position and salary, full particulars of qualifications and experience to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by the 7th August, 1954. Quote reference ER/497. 4235

CONSULTING ENGINEERS

with extensive practice require the following Drawing Office staff. Salaries in all cases will be above A.E.S.D. rates. Conditions are excellent and pension scheme is in operation. The positions are permanent and promotion prospects are good.

1. SENIOR DRAUGHTSMEN. Sound experience of aircraft structures, for work on the South Coast.
2. DRAUGHTSMEN, sound experience of mechanical design and/or detailing, for interesting work on turbine equipment. Work is in Birmingham.
3. DETAILER DRAUGHTSMEN, sound experience of heavy mechanical equipment, for work in Sheffield.
4. DRAUGHTSMEN, sound experience of plant layout and structural engineering, for work in Weston-super-Mare district.
5. DRAUGHTSMEN, sound experience mechanical engineering, for work in the Weston-super-Mare district.
6. DRAUGHTSMEN with sound experience of electrical equipment design and/or detailing, for work in Bath and Chester.

Subsistence expenses paid to men coming from outside the districts mentioned, except Weston-super-Mare. Please send full particulars of experience, qualifications and age to—Box 4264.

BRITISH ELECTRICITY AUTHORITY

South Western Division

ASSISTANT ENGINEER (Combustion and Efficiency) required at Hayle Generating Station.

Superannuation scheme. Salary N.J.B. Class F, Grade 7, £697-£718.

Candidates should have had all round station experience on boiler and turbine plant, be conversant with instrumentation and automatic combustion control. H.N.C. (Electrical or Mechanical) or equivalent an advantage.

Applications on Form A.E.6/ACT, obtainable from your place of employment or the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 3rd August, 1954.

Previous applicants need not re-apply. 4255

BRITISH ELECTRICITY AUTHORITY

South Eastern Division

SHIFT CHARGE ENGINEER, Brighton "A" Power Station. Applicants should have had sound technical training together with extensive experience in the operation of modern high-pressure turbine and boiler plant, E.H.T. switchgear and in the control of labour. P.F. experience an advantage. N.J.B. conditions of service. Class H, Grade 7, £772 p.a.

Applications giving details of education, present position, experience, etc., should be received by the Station Superintendent, Brighton Power Station, Portslade-by-Sea, Sussex, by 31st July. 4260

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT of DISTRICT ENGINEER, ROSSENDALE DISTRICT. Applicants should have had a sound training in electrical engineering and considerable experience in the operation and maintenance of high and low voltage networks (overhead and underground) and substations, the supervision of constructional work, and the keeping of essential records of mains and substation equipment and layouts. The successful applicant will be responsible for the general maintenance of supply in the district.

Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary scale £941/£982 p.a., Grade E.2. N.J.B. conditions.

Applications to Sub-Area Manager, No. 5 Sub-Area, North Western Electricity Board, Jubilee Street, Blackburn, by 31st July, 1954.

Appointment of JOINTER (EXTRA HIGH TENSION), NEW MILLS. Rate of pay 45.0d. per hour. N.J.I.C. conditions.

Application forms can be obtained from the Sub-Area Manager, No. 7 Sub-Area, North Western Electricity Board, Chapel St., Hazel Grove, Cheshire, and should be returned to him by 31st July, 1954. 4220

DESIGN ENGINEER

AN EXCEPTIONAL OPPORTUNITY exists in SOUTH EAST LONDON for a DESIGN ENGINEER with sound theoretical knowledge and recent industrial experience in the design of A.C. and D.C. machines, and low voltage control gear.

This appointment offers rapid advancement to a position of superior technical and administrative responsibility. The salary will be commensurate with the requirements.

Applications, giving full details of training and experience, should be sent to—Box 2V, G7250, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2.

4013

SOUTH EASTERN ELECTRICITY BOARD

DEMONSTRATOR, Crawley District. Salary £400 × £20 to £480 × £10 to £490 p.a. under N.J.C. Grade 1. Applicants should have showroom experience, be capable of demonstrating electrical appliances both in showrooms and on consumers' premises, and possess a recognised diploma or certificate in domestic science and the E.A.W. certificate.

Applications naming 2 referees, to F. A. Avery, A.I.E.E., District Manager, SEEBoard, 55, High Street, Crawley, by 4th August, 1954.

FITTER (Electrical), Croydon District. Wages 4s. 1d. per hour for 44-hour, 5-day week under N.J.I.C. Agreement, for work in connection with erection and maintenance of 33kV, 11kV and 2.2 kV switchgear and transformers.

Applications, naming 2 referees, to H. Lowe, M.I.E.E., District Manager, SEEBoard, Electric House, Wellesley Road, Croydon by 4th August, 1954.

A. L. BURNELL,
Secretary.
4256

NORTH EASTERN ELECTRICITY BOARD

Wear Sub-Area

APPLICATIONS are invited for the appointment of SECOND ASSISTANT DISTRICT ENGINEER, Crook District. Salary, Schedule A, Class D, Grade 7, £633/£643 p.a. N.J.B. conditions of service.

Applications, stating age, qualifications and experience, should be forwarded to the Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 4254

UGANDA ELECTRICITY BOARD

APPLICATIONS are invited for appointments as CHARGE ENGINEERS on the permanent staff of the Board for duty at the Owen Falls Hydro-Electric Station. Applicants should have had a sound technical training and subsequent experience in the operation of generating stations.

Commencing salaries will be in the scale of £891 to £1,161 per annum (including 35% temporary allowance) to be determined according to age and experience.

Free partly furnished accommodation or allowance in lieu; free medical and dental treatment; three years' contract in first instance with leave thereafter on full pay; free passages for successful candidates and their families to a maximum of 3 adult fares in each case.

Application forms and further information obtainable from the Board's London Office, 2, Regent Street, London, S.W.1. Completed application forms should be returned to the London Office within two weeks of the appearance of this advertisement.

C. R. WESTLAKE,
Chairman.
Kampala, Uganda,
East Africa. 42

SOUTH WEST SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the post of THIRD ASSISTANT ENGINEER (Planning and Development) (2 appointments) in the Chief Engineer's Department. Applicants should have had works experience of manufacture and design of distribution plant, and preferably have had some experience of the design, construction and operation of a 33-kV distribution system. A specialised knowledge of some branch of distribution engineering would be an advantage. Salary N.J.B. Schedule C, AX/DX, £649/£858 per annum.

The posts are superannuable. Applicants should possess a degree or equivalent qualification in electrical engineering and be Corporate Members of the Institution of Electrical Engineers.

Forms of application may be obtained from the undersigned, and should be returned to the undersigned not later than Saturday, 31st July, 1954.

J. MEEK, Secretary.
62, Dalziel Drive,
Glasgow, S.1. 4112

BRITISH ELECTRICITY AUTHORITY

South Wales Division

APPLICATIONS invited for the following superannuable N.J.B. appointments:

STATION SHIFT CONTROL ENGINEER, LLANELLY POWER STATION (Vacancy No. 73). Salary, Class E, Grade 10, £555-£569 per annum. H.N.C. and experience in power station control room desirable.

UPPER BOAT POWER STATION
(Vacancy No. 75)

1. ASSISTANT MAINTENANCE ENGINEER (MECHANICAL). Salary, Class H, Grade 9, £680-£706 per annum. H.N.C. and previous maintenance experience essential.

2. STATION SHIFT CONTROL ENGINEER. Salary, Class H, Grade 10, £641-£667 per annum. H.N.C. and experience in power station control room desirable.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 9th August, 1954. 4259

BRITISH ELECTRICITY AUTHORITY

Research Laboratories, Leatherhead

GENERAL ASSISTANT ENGINEER required with a university degree in electrical or mechanical engineering or in physics. Duties include testing, development and research work in the laboratories and in the field in connection with the generation, transmission and distribution of electricity.

Salary N.J.B. Grade 5, £531-£732.

Forms from D. Moffat, Director of Establishments, Winsley Street, London, W.1, to be returned by 7th August, 1954. Quote reference ER/481. 4206

INSTRUCTOR IN GENERAL ELECTRICAL ENGINEERING

required by the MOMBASA INSTITUTE OF MUSLIM EDUCATION, KENYA, for one tour of 3 years in the first instance, with prospect of further employment by mutual agreement. Salary scale (including present temporary allowance of £165/£300 a year), £715 rising to £1,024 a year. Commencing salary according to age, qualifications and experience. Outfit allowance £30. Contributory superannuation scheme. Free passages and free furnished quarters. Liberal leave on full salary.

Candidates, between 23 and 35 years, should have served an appropriate apprenticeship and have wide subsequent practical experience, including outside wireman's work. They must be capable of instructing in all forms of general electrical engineering, both in theory and in practice, and should hold a C. & G. Certificate or equivalent qualification.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/30683/EF. 4248

ELECTRICAL RESEARCH AND TESTING ENGINEERS

A. REYROLLE & CO. have a number of vacancies for Engineers to be engaged on ELECTRICAL RESEARCH and LABORATORY TESTING in connection with switchgear, protective gear, insulation, etc.

For certain of the vacancies an Honours or Pass Degree is required; for the others a Higher National Certificate is adequate. The work will be varied and interesting and there will be good scope for advancement. Starting salaries in accordance with age, technical qualifications and experience.

Apply with full particulars to the Chief Engineer, A. Reyrolle & Company Ltd., Hebburn, Co. Durham.

4164

COUNTY BOROUGH OF SOUTHEND-ON-SEA

ASSISTANT ELECTRICAL ENGINEER, Grade A.P.T. IV (£580-£15(3)-£625). Applications are invited for this established post in the Borough Architect's Department.

Applicants should be experienced in the design, preparation of drawings and specifications and in the supervision of electrical installations of large buildings, etc.

Preference will be given to holders of a Higher National Certificate or equivalent.

The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and the N.J.C. scheme of conditions of service. Medical examination.

Applications stating age, qualifications and experience, with the names of two persons to whom reference can be made, should be submitted to the Borough Architect, 30, Alexandra Street, Southend-on-Sea, not later than Thursday, 12th August, 1954.

ARCHIBALD GLEN, Town Clerk.

4262

SOUTH WEST SCOTLAND ELECTRICITY BOARD

Clyde Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER required for Greenock District. Salary scale N.J.B. Agreement, Class E, Grade 7, £649/£681 per annum. The post is superannuable.

Applicants should preferably be Graduates of the Institution of Electrical Engineers or hold equivalent qualifications, and have experience of H.V. and L.V. overhead and underground distribution systems.

Applications should be forwarded to the undersigned, South West Scotland Electricity Board, Clyde Sub-Area, 206, St. Vincent St., Glasgow, C.2, not later than Wednesday, 28th July, 1954.

DANIEL ROSS,
Manager. 4265

ADMIRALTY—ROYAL NAVAL SCIENTIFIC SERVICE

SENIOR SCIENTIFIC OFFICERS and SCIENTIFIC OFFICERS required in Experimental Establishments in London, Portsmouth, Weymouth and Gloucestershire areas and Scotland. The majority of posts are for Engineers and Physicists (particularly with Electronics).

Candidates must be British subjects with an appropriate first or second class honours degree or equivalent high professional attainments.

Salaries: S.S.O. (M) £975-£1,150; S.O. (M) £470-£855. London rates. Somewhat lower in Provinces. All appointments are unestablished (with F.S.S.U.), but with some opportunities to compete for established posts.

Application forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting A.246/52/A. 3723

A LARGE electrical wholesaler has vacancy for sales representative London area. Applications invited from men with sound selling experience to call upon contractors and industrial users. Applicants should be car owners. Remuneration will be by salary, commission and expenses. Details of this advertisement are known to our staff.—Box 4165.

A WELL-KNOWN electrical company has a vacancy for a senior sales engineer based on their London office. The successful applicant must be a trained electrical engineer with Ordinary National Certificate as a minimum qualification and with previous experience in the London or South Eastern counties area. The post carries a responsibility for the organisation and control of three sales engineers. A generous salary is offered together with non-contributory pension scheme.—Box 4166.

ADDITIONAL electrical surveyors are required by the Vulcan Boiler & General Insurance Co. Ltd., at Glasgow, Kendal and York. Applicants should possess a Higher National Certificate or equivalent in Electrical Engineering and have practical experience with electrical plant and machinery. Age about 30 years. Commencing salary £540, rising by annual increments to £785 per annum. Pensionable. Applications to 67, King Street, Manchester, 2. 4272

ALKALINE BATTERIES Ltd., of Redditch, are the largest makers in the Empire of alkaline accumulators, miners' lamps and emergency lighting systems, which are in rapidly growing use particularly for export. The company has vacancies in its technical sales and development sections for graduate electrical engineers, not over 30 years of age, or for men nearing the end of their degree course who have completed National Service. The posts are pensionable and offer the prospect of executive rank. Applications with full educational details and experience should be addressed —Commercial Manager, Alkaline Batteries Ltd., Union Street, Redditch. 3936

APPLICATIONS are invited by well-known London building contractors for post of assistant manager in the electrical department. Applicants must be experienced in the preparation of schemes, specifications and estimates for large office buildings, factories, etc., and site supervision of such work. Write giving full particulars of experience, qualifications, etc., to—Box 4199.

ASSISTANT chief engineer required by company engaged in the design and development of guided weapons. Candidates must be mechanical engineers with first-class qualifications and experience in electronics and light engineering. Knowledge and experience in servo-mechanisms essential since duties would include responsibility for missile control systems, electrical gyros, accelerometers, etc. Applicants should be 30-35 years of age and have sufficient personality and experience to administer and organise the development activity on these subjects. Write in detail, quoting reference G, to—Box AC.91032, Samson Clarks, 57/61, Mortimer Street, London, W.1. 123

ASSISTANT required in the sales office of a cable manufacturing company in the Manchester area, age 25-30 years, preferably with experience in the cable trade but not essential, capable of dealing with correspondence on own initiative. Canteen facilities. Pension fund. State age, experience and salary required to—Box 4196.

APPLICATIONS are invited for sales representation from engineers who have extensive connections with the marine field, to represent a company manufacturing alternators and generators of medium and large sizes, who wish to establish themselves in the marine field. Please submit proposals to—Box 4082.

ASSISTANT engineer required with Honours Degree in electrical engineering and preferably having served an apprenticeship with a firm of national repute. Experience in various types of industrial drives and controls and in power generation and distribution an advantage. Age 25/30. Write giving fullest particulars and salary required, to the Personnel Officer, British Cellophane Limited, Bridgwater, Somerset, quoting Ref. No. E8.ER. 4278

ASSISTANT to senior life test engineer required by well-known capacitor manufacturers in S.W. London area. Suitable applicant will be responsible for the day-to-day running of the life test section. Applicants must have a good electrical background, both theoretical and practical, with education to H.N.C. or B.Sc. standard. Apply in writing stating age, experience and salary required to—Box 4077.

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE Company Ltd., 24, Fennel Street, Manchester, 4. The company requires additional electrical plant inspectors in one or two districts. Permanent positions carrying progressive salary scale £540 to £785 and non-contributory pension. Candidates, age 26 to 30 years, with apprenticeship in the manufacture or repair of electrical machinery, and preferably with subsequent experience of industrial use of electrical machinery, and who have gained the Higher National Certificate in Electrical Engineering or are Graduates of the Institution of Electrical Engineers, are invited to apply in own handwriting stating age, qualifications and experience. 4266

BUYER required to take charge of section dealing with supplies of battery-operated traction motors, control gear and ancillary equipment. Must have full technical understanding of equipment and materials used in the electrical industry. Company situated in pleasant country surroundings one hour west of London. Good working conditions. Canteen. Please write stating age, qualifications, married/single, previous experience, present salary, to —Box 4095.

CHARTERED engineer with commercial experience for residence in Arabic-speaking country to organise electrical/mechanical sales of capital plant. Salient particulars only to—Engineer, G.P.O. Box 560, London E.C.3. 4208

COOKE & FERGUSON Limited, switchgear specialists, require a sales engineer for engineering of schemes and preparation of tenders for indoor and outdoor switchgear. A knowledge of protection is essential, and applicants must be qualified in electrical engineering to at least H.N.C. standard. Salary commensurate with qualifications and experience. Please reply stating age, experience and qualifications to—Personnel Officer, Saxon Works, South Street, Openshaw, Manchester, 11. 4239

COVENTRY Corporation requires qualified heating and ventilating engineers, A.P.T. VI (£695-£760) and A.P.T. III (£550-£595). Housing accommodation in approved circumstances. Application forms and conditions from City Architect, Bull Yard, Coventry, returnable by 5th August. 4222

DESIGN draughtsman. A vacancy exists in our design drawing office for a first-class designer draughtsman for interesting work associated with the development of automobile electrical equipment. He should be at least of H.N.C. standard and experience in the design of light electrical equipment for large quantity production would be an advantage. The post provides excellent scope for initiative and advancement. Reply stating qualifications, experience and age, to—Personnel Manager, Joseph Lucas Ltd., Great King Street, Birmingham, quoting reference PM/D/93. 143

DESIGNER required for work on medium and high-voltage power factor correction and furnace capacitors. Must have degree or H.N.C. or the equivalent in electrical engineering, and experience in the design and manufacture of medium/heavy electrical equipment. Good prospects. Write, giving full details of qualifications, age and salary required, to—The Technical Director, A. H. Hunt (Capacitors) Ltd., Bendon Valley, London, S.W.18. 4076

DESIGNS draughtsman required by electrical engineering co. in East Manchester area. Previous experience in electrical engineering is desirable. Applicants should state age and give details of experience and technical qualifications to—Box 4270.

DRAUGHTSMAN for lighting fittings design. Some experience in estimating an advantage. Reply in confidence giving fullest details of training and experience, stating age and salary required, to—R. & A. G. Crossland Ltd., Cartbridge Lane, Walsall. 4210

DRAUGHTSMAN required by London consulting engineers with extensive practice, for the reproduction of electric light and power schemes. Previous experience essential. Write stating age, experience and salary required to —Box 4123.

DRAUGHTSMAN required for development work on low voltage control gear. Mechanical background is required with sound electrical experience. Pleasant country surroundings, 1 hour London. Good working conditions. Canteen. Housing assistance if required. Please write, giving age, qualifications, past experience, married/single, present salary, to—Box 4274.

DRAUGHTSMAN with light mechanical and electrical design experience for interesting development work. Pinner area. Write stating details of experience, salary required, etc.,— Box 508, Sells Ltd., Brettenham House, Strand, London, W.C.2. 4201

DRAUGHTSMEN. Previous experience in motor control equipment circuit work helpful but not essential if applicants are up to O.N.C. standard. Good salary and prospects. For successful applicants requiring housing accommodation, assistance may be given for skilled and key personnel. Pension scheme; 5-day week; canteen. Details of age, experience, qualifications and commencing salary to —Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 4200

ELECTRICAL and mechanical draughtsman wanted for manufacturing electrical engineers, West London district. State age, experience and salary.—Box 4044.

ELECTRICAL contractors in Central London area require estimating engineer with experience of good-class commercial and industrial installations. Apply in confidence stating age, experience and salary required.— Box 7515.

ELECTRICAL draughtsman for London office with experience power and substations layouts and diagrams. 5-day week; free luncheons; pension fund. Write—Box E.R.994, c/o 191, Gresham House, London, E.C.2. 4240

ELECTRICAL draughtsman required for control gear circuit diagrams. Lift experience preferable but not essential. Write stating age, qualifications and salary expected to— J. & E. Hill Ltd., Lift & Escalator Department, Dartford. 4250

ELECTRICAL draughtsman required for design of works substations, H.T. and L.T. distribution systems, lighting layouts, etc. Apply, giving full details of age, training, experience and technical qualifications, to—The Lancashire Steel Corporation Ltd. Irlam Works, Irlam, Manchester. 4078

ELECTRICAL engineer, age 25-30, with good degree, preferably some experience in a research or development laboratory, is required for work on the application of electronic techniques to industrial measurement and control. This post is permanent, pensionable and offers good prospects. Apply in writing, giving full chronological details of qualifications and experience, together with age and salary required, to—Tube Investments Ltd., Dept. of Development & Research, Plume St., Aston, Birmingham, 6, quoting Ref. F.2. 7506

ELECTRICAL engineer, aged 23/28, with leanings towards commercial work, required by well-known porcelain insulator manufacturers in the Midlands. The successful applicant would receive training in H.T. insulator design department and would be considered for subsequent transfer to technical sales. Starting salary £450 to £750 p.a. according to age and qualifications.—Box 4203.

ELECTRICAL engineer required as assistant in section dealing with the design of power plant for telephone exchange contracts. Must have sound knowledge of A.C./D.C. control circuits. Write, giving full details of training and experience, to Personnel Officer, Ericsson Telephones Limited, Beeston, Nottingham. 4016

ELECTRICAL engineer wanted (aged 30-40, preferably chartered) to assume leading position, commanding equivalent £1,000 p.a. to start, in design office of London company manufacturing automatic precision machinery. Previous drawing office and industrial experience of control gear and mechanisms essential.— Box 4202.

ELECTRICAL engineering assistants req'd with expce. of installations in large buildings or of lift practice. H.N.C. (Elec.) or O.N.C. (Elec.) preferred. Salaries within range £300-£739. Appl. form from Chief Engineer (54/36), London County Council, County Hall, London, S.E.1, returnable within next 14 days (enclose S.A.E.). (939) 4241

ELECTRICAL engineers, junior technical engineers required for development, application and pre-production of thermionic valves. Minimum desirable qualification, O.N.C., Inter B.Sc. or equivalent. Write to Personnel Department, The M. O. Valve Co. Ltd., Brook Green, Hammersmith, W.6. 4275

ELECTRICIAN (installation) required by British building contractors for work in Middle East. Must be familiar with Pyrotenax wiring and jointing, fully experienced in trade and in supervisory positions. Write giving details of past employers, experience and age to—Box 4224.

ELECTRONIC engineer required by capacitor manufacturers (East London) for development work on test instruments and electrical research. Opportunity for young engineer with some years' experience.—Box 4225.

ELLIOTT BROS. (LONDON) Ltd. invite applications for appointment as sales and contracts engineer for their electrical instrument measuring division. Electrical engineering background to H.N.C. level and experience of quotation work in the industry desirable. Applications in confidence stating experience, age and salary required to—Personnel Manager, Century Works, Lewisham, London S.E.13. 4143

ENGINEER/draughtsman required by South Lancashire firm manufacturing special purpose machines. Applicants should be at least O.N.C. standard and have some drafting experience of control circuits, etc. Reply stating age, qualifications, experience, salary required, to—Box 4280.

ENGINEERS wanted for sales office of automatic temperature control manufacturers 20 miles London. H.N.C. or equivalent. Write stating age and experience to—Box 4096.

FOREMAN electrician required by leading London lamp manufacturer, must be capable of maintaining electrical installations and lamp testing equipment. Excellent opportunity for man with initiative, weekly salary and prospects. Write, giving full details of age, past experience and salary required, to—Box 7510.

FOREMAN required for miniature lamp production, preferably with knowledge of sealing and pumping. Excellent opportunity for the right man. Apply, giving details of past experience and salary required, to—Box 7509.

FOREMAN supervisor experienced overhead transmission lines and underground cable work for contractors working Midlands and Southern England; also for work in Middle East and East Africa. Write details age, experience, etc., to—Box 3967.

INDUSTRIAL electrical and mechanical repair specialists require a young engineer representative for the London district. Applications in confidence to — London Sales Manager, Dowding & Mills Ltd., 26, White Post Lane, London, E.9. 4046

INDUSTRIAL lighting fittings manufacturers (Midland area) require a man with drawing office experience, able to handle enquiries estimating, etc., in preparation for manufacture. Good prospects. Give particulars of experience, age and salary required.—Box 4209.

JOINTER and mates urgently required for long-term contract in Home Counties. Apply, giving details of experience and when available, to—Box 4047.

JOINTER/plumber/cable, first-class high tension, required for 12 months' service overseas by large firm electrical engineers. Write fully age, experience.—Box 4227.

JUNIOR draughtsmen required by manufacturers of medium voltage switchgear; 5-day week and superannuation scheme. State age, technical qualifications and salary required to —Ottermill Switchgear Ltd., Ottery St. Mary, Devon. 4226

JUNIOR electrical engineer, 22/26, required to prepare control schemes, requisition electrical control gear and prepare diagrams for tracing for mechanised electric and gas-fired furnaces. H.N.C. desirable. Apply in writing to — Personnel Officer (J.C.), Birlec Limited, Tyburn Road, Erdington, Birmingham, 24. 4212

JUNIOR engineer for transformer sales and estimating department. Some experience transformers advisable but not essential. Outer London area.—Box 4214.

LABORATORY technician (radio) at South East London Technical College, Lewisham Way, London, S.E.4. Rate 73s. 6d. a week (16 to 102s. at 19, £286 17s. 6d. a year at 20, £19 2s. 6d. to £401 12s. 6d. with certain quals. to £439 17s. 6d. (max. comm. sal. £363 7s. 6d. Further partics. and appl. forms, returnable within 14 days, from Secretary. (942) 4211

LAYOUT draughtsmen required by consulting engineers for electrical layout work including H.V. and L.V. outdoor substations, outdoor switchgear and cable diagrams. Applicants should possess or should be studying for H.N.C. or equivalent. Salary in accordance with qualifications. Apply in writing, referring KJB/RFS, to—Messrs. Kennedy & Donkin, 4, Caxton St., Westminster, London, S.W.1. 4207

LIAISON engineer, with experience and ability to contact aircraft constructors and commercial customers, required by a large manufacturing company situated in the West Country. Must have sound technical training in the light electrical engineering field, be energetic and keen, with ability to obtain new business in the face of strong and established competition. Please write in the first instance, giving details of education, previous experience and salary required, to—Box 4204.

MAINTENANCE electrician required for large asphalt plant in S.E. London. Experience in elect. sequence control desirable. E.T.U. rates plus bonus.—Box 7504.

MAINTENANCE electricians required for steel works plant in Cardiff. Knowledge of automatic control gear for A.C. and D.C. motors essential. Must be members of E.T.U. Day work on 44-hour week but prepared to work shifts on 48-hour week.—Box 4243.

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OVERHEAD linesman, first-class high tension, required for 12 months' service overseas by large firm electrical engineers. Write age, experience.—Box 4228.

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POST graduate apprenticeships. Prominent switchgear manufacturing company invites applications from young engineering graduates for a two-year course of training with interesting posts in designs, development, sales and contract work available on completion. Applicants should have obtained a university degree in electrical engineering or technical college diploma of equivalent standard. Applications from men who have completed their National Service will receive special consideration. Full information may be obtained from the Personnel Manager, Ferguson Pailin Ltd., Higher Openshaw, Manchester, 11. 4271

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PROMINENT electrical wholesale house in the North-West, stocking C.M.A. cables, E.S.M.A. lamps and leading manufacturers' products have vacancy for experienced industrial representative. Must be fully conversant with industrial electrical requirements, and some knowledge of industrial electronic applications would be useful. The possession of some connections would be an advantage in forming the nucleus of a remunerative post for a man who is prepared to work hard. A car would also be an advantage. Pension scheme. Apply in confidence with full details of age, experience and all relevant information to—Box 4144.

PUBLIC relations officer required for large engineering organisation in Midlands. Practical experience in industrial publicity essential. Good prospects for man of managerial calibre. Age about 35/40. Particulars and salary required to—Box 4229.

PURCHASING manager required for company manufacturing light electrical goods and control gear. Age between 30-40 years. Apply stating qualifications, experience and salary required.—Box 4273.

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SALES engineers, D.C. and A.C. motors and control gear, required London, Manchester and Birmingham areas. Outside sales experience essential.—Box 4177.

SENIOR draughtsman required for mechanical design work on electrical rotating machines for application to diesel-electric locomotives. Candidates must be fully qualified draughtsmen with H.N.C. (electrical or mechanical) and previous experience in either traction machines or industrial D.C. machines. First-class service conditions, including a non-contributory staff pension scheme, and good commencing salary. Please apply with full details to the Chief Personnel Officer, Brush Bagnall Traction Ltd., Loughborough, Leics. 4149

SHIFT control engineer required by the Steel Company of Wales Limited (Steel Division) at their Margam power plant. Applicants should possess evidence of advanced technical training and have knowledge of the operational control of H.T. inter-connected network, together with some experience in turbine and boiler operation. Higher National Certificate or equivalent desirable. Salary £775 per annum according to qualifications and experience. Those wishing to apply should write for official application form to—The Personnel Superintendent, The Steel Company of Wales Ltd., P.O. Box No. 3, Port Talbot. 4163

STOREKEEPER/warehouseman required by electrical wholesalers in E.C.1 district, write stating experience, wages required. Do not send stamped addressed envelopes.—Box 7525.

SWITCHGEAR draughtsman, experienced in layout and diagram work for general contract work, required by electrical engineering co., Manchester area. Good conditions and prospects. Please state experience, age and salary required, to—Box 4268.

TECHNICAL assistant (electrical engineering) required for design and layout of electrification schemes, with good practical training. The scope of work includes H.T. and M.T. distribution, electrical installations in various types of buildings, illumination schemes (general), together with some experience in preparation of specifications and estimating. Applicants should be 25 years of age or over and preferably hold the Higher National Certificate in Electrical Engineering or equivalent and have served an apprenticeship. The work will be carried out in the Ruislip (Middlesex) area. Write—Frederick S. Snow & Partners, Monro Building, Wellington Street, London, W.C.2. 4231

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TRANSFORMER engineer required for sales and estimating department. Must be capable of handling tenders for transformers up to 20,000 kVA. Outer London area.—Box 4213.

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GENERATING sets for power, lighting and welding, for sale; diesel, steam, petrol and gas, A.C. and D.C., from ½ to 500 kW.—Fyfe, Wilson & Co. Ltd., Bishop's Stortford. 4283

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GENERATING sets, petrol engine-driven dynamos, 110 volts and 220-440 volts, direct current. — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 18

GEORGE Ellison low tension 1-phase switchboard fitted 3-phase and neutral busbar chamber and four outgoing draw out type oil immersed double pole circuit breakers, 3 × 60 amp. 1 × 20 amp. capacity.—Whitefield Machinery & Plant Limited, Cobden Street, Salford, 6 (Tel.: Pen. 1373/4746). 4288

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IMMEDIATE delivery new 330-kVA, 400-volt, 3-phase, 50-cycle, 4-wire B.T.H. alternator direct coupled to 400-h.p. Paxman diesel engine, 1,000 r.p.m., complete with switchboard and A.V.R. control.—C. J. Ferguson & Sons Ltd., 33, Barbican, London E.C.1 (Monarch 5474/5). 104

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NEW 12.5-kVA, 380/220/3/50 Lister diesel set, 1,000 r.p.m., radiator for tropics, switchboard; cancelled export.—Fyfe, Wilson & Co. Ltd., Bishop's Stortford. 4284

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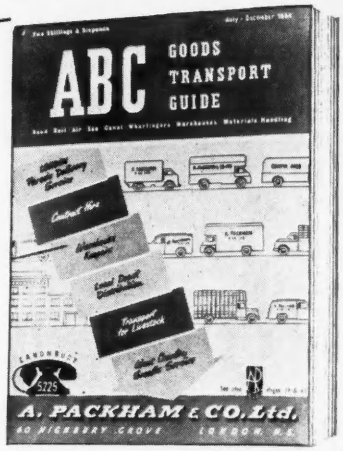

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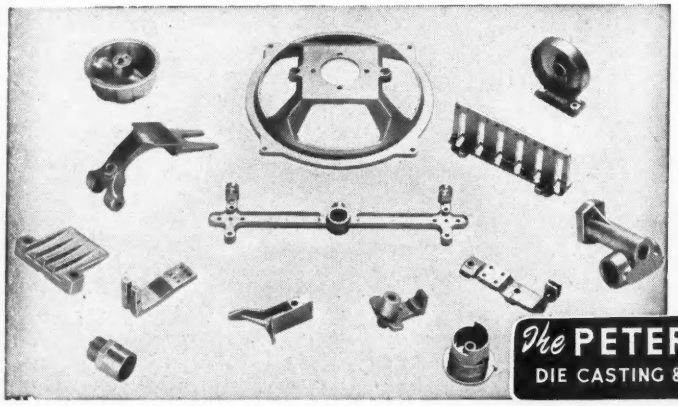

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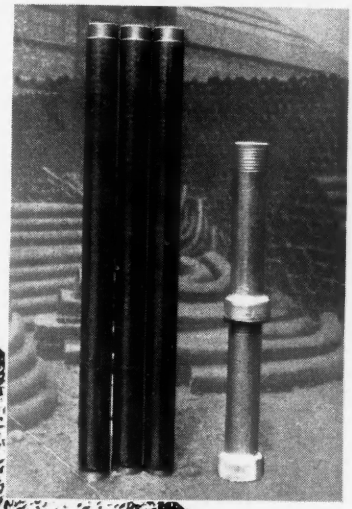

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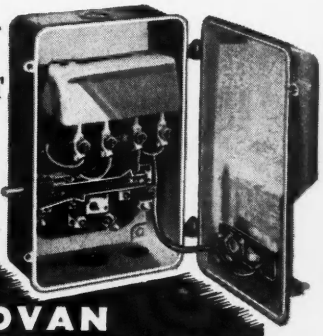

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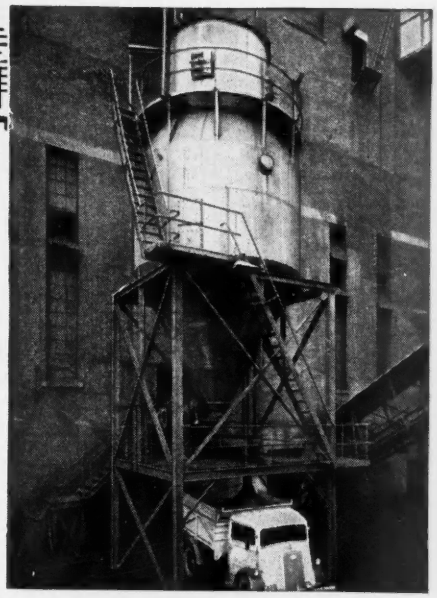

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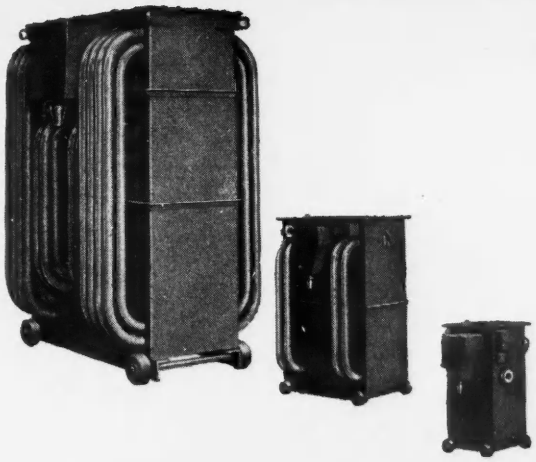

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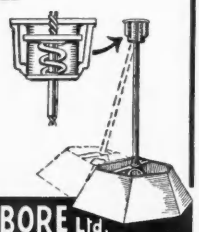

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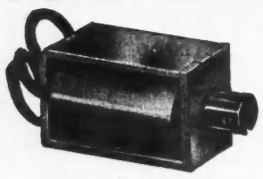

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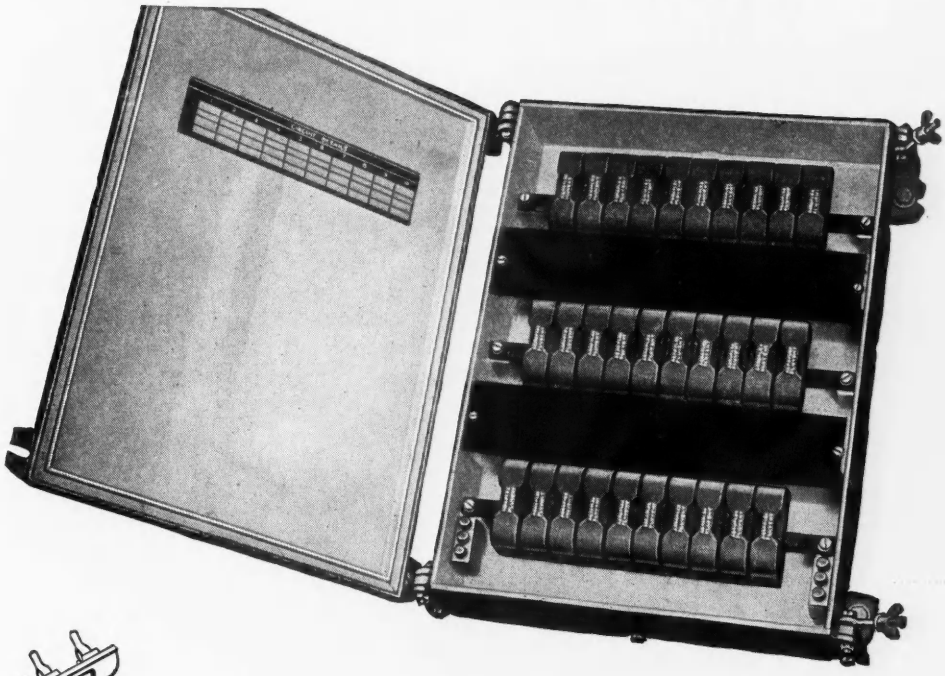

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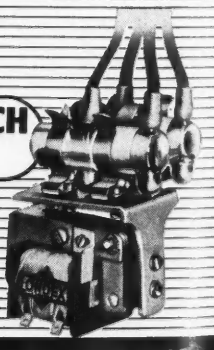

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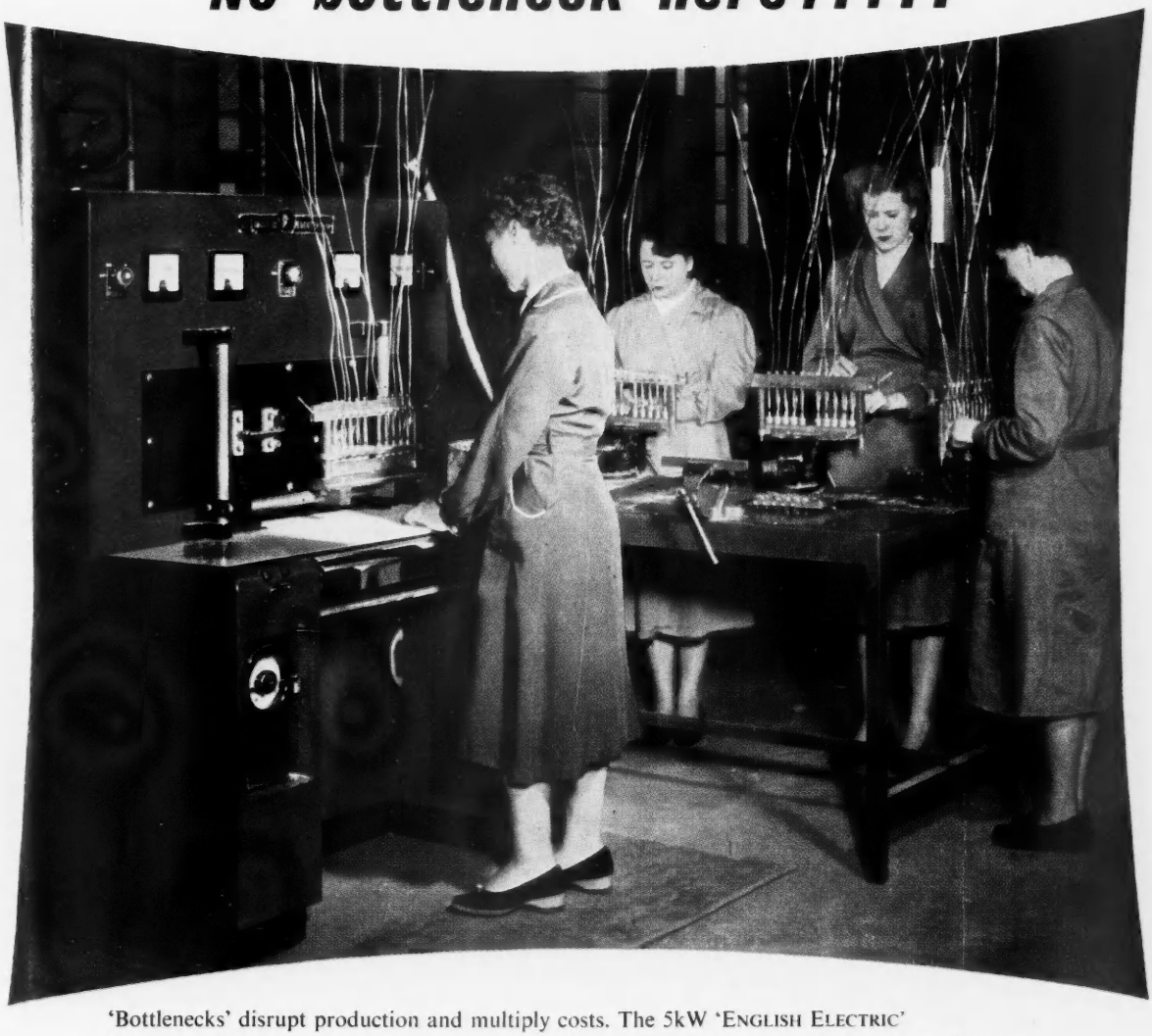

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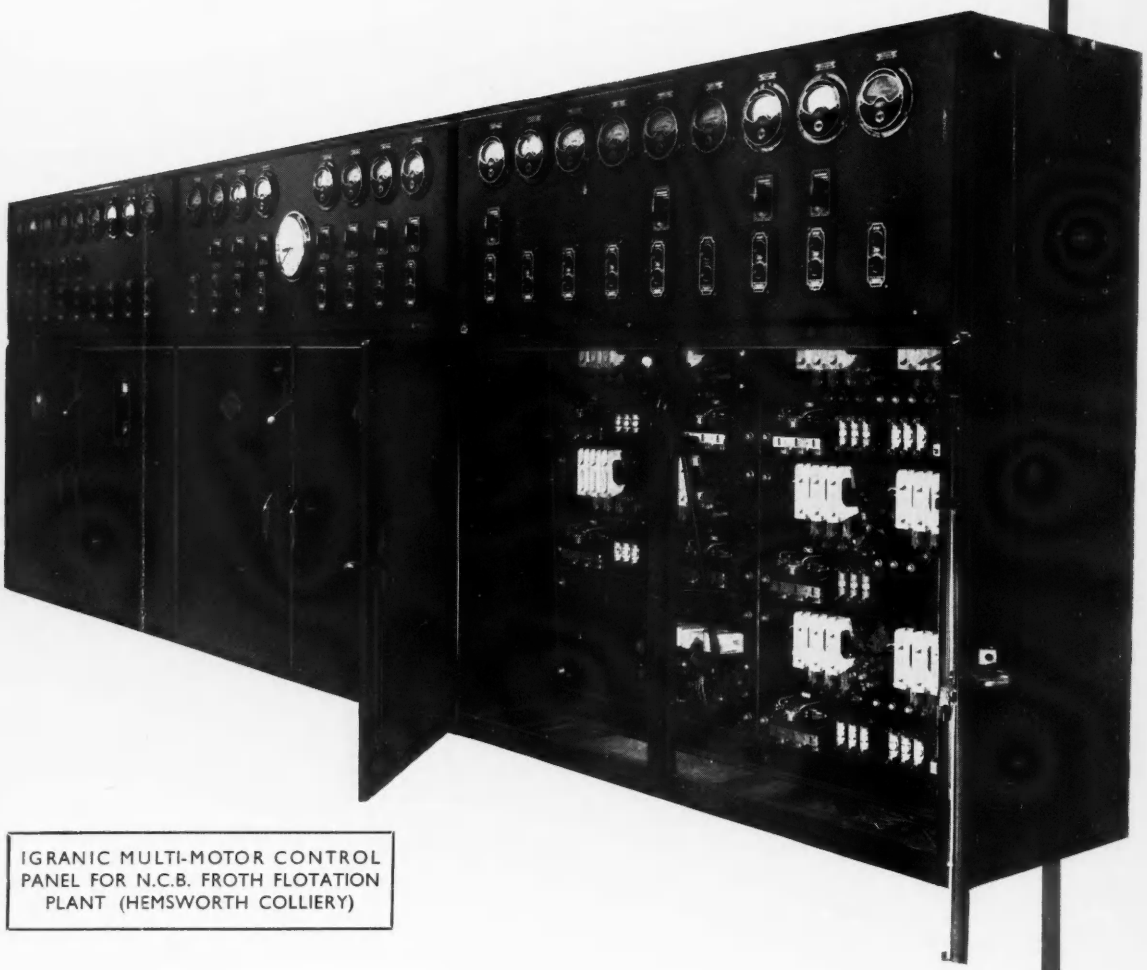

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